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It Isn't Easy Speaking Green: The Influence of Moral Factors on the (Non-) Adoption of Pro-Environmental Behaviors, Deferral, and Back Again

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IT ISN'T EASY SPEAKING GREEN: THE INFLUENCE OF MORAL FACTORS ON THE (NON-) ADOPTION OFPRO-ENVIRONMENTAL BEHAVIORS, DEFERRAL, AND BACK AGAIN

by

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ABSTRACT

It Isn't Easy Speaking Green: The Influence of Moral Factors on the (Non-) Adoption of Pro-Environmental Behaviors, Deferral, and Back Again

by

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Utah State University, 2021

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Climate change is one of the major issues humans face in the 21st century. This decade is critical in shaping the future of Earth and the way humans live on it (IPCC, 2018). Changes in human behavior are necessary to mitigate and adapt to climate change. This series of studies explored factors important in communicating and implementing environmental behavior. The first study tested the effects of a carbon calculator with moral foundations-based interventions on three self-reported measures and one objective measure of behavior over a period of weeks. The interventions resulted in small changes in self-reported behavior and no change in electricity usage. Given participants adopted relatively few additional behaviors, the next study investigated the predictors of adoption and non-adoption of specific pro-environmental behaviors more in-depth. Participants were also asked whether they, businesses, non-profits, or governments were responsible for spearheading efforts to perform a behavior when they as individuals could perform the behavior but did not. Although the results indicate that most participants attributed responsibility to themselves and that self-efficacy is important to behavioral decisions, predictors vary between behaviors.

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PUBLIC ABSTRACT

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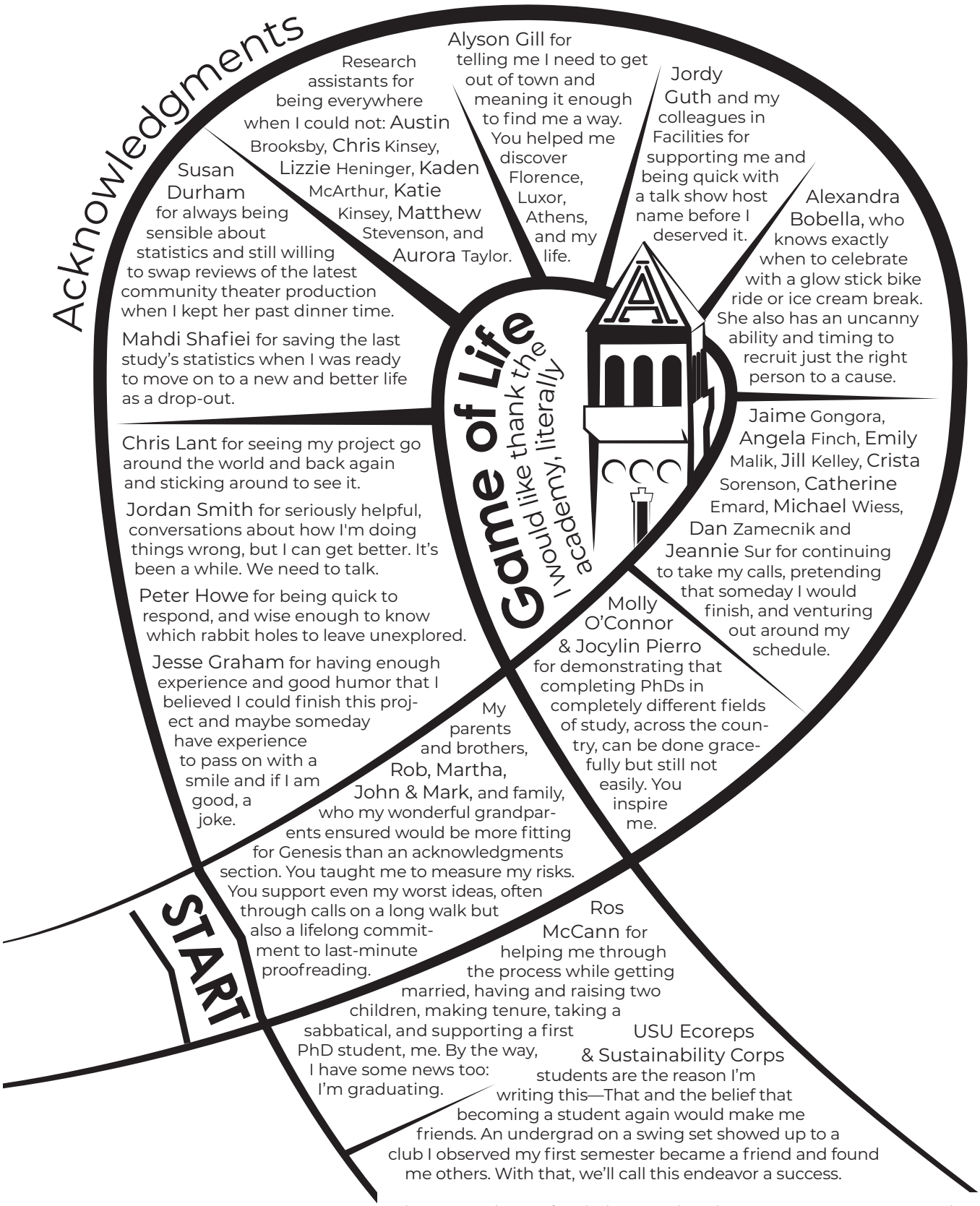
Climate change is one of the major issues humans face in the 21st century. This decade is critical in shaping the future of Earth and the way humans live on it (IPCC, 2018). Changes in human behavior are necessary to mitigate and adapt to climate change. This series of studies explored factors important in communicating and implementing environmental behavior. The first study tested the effects of an online, interactive carbon calculator with moral interventions on three self-reported measures and one objective measure of behavior over a period of weeks. The interventions resulted in small changes in self-reported behavior and no change in electricity usage. Given participants adopted relatively few additional behaviors, the next study investigated the predictors when people perform or do not perform specific pro-environmental behaviors more in-depth. Participants were also asked whether they, businesses, non-profits, or governments were responsible for spearheading efforts on a behavior when they, as individuals, could perform the behavior but did not. The results indicate that most participants attributed responsibility to themselves. However, belief in one's own ability to perform the behavior is important to behavioral decisions, and predictors vary between behaviors.



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CHAPTER 1

INTRODUCTION

Twenty years after the turn of the century the world had problems. Yes, carbon dioxide was in the air, but it was the 1920s, and as engines approached their maximum load, they exhibited a knock that could destroy them. After diligent testing of 33,000 compounds in his time at General Motors, Thomas Midgley Jr. discovered a solution, tetraethyl lead, on December 9, 1921 (Nriagu, 1990). After a stint in other research, the man who solved the knock problem was back in the lab for the Frigidaire division working on another dilemma. Refrigerants were toxic or flammable, which made leaks a household and industrial hazard. Midgley and his assistant, examining his periodic table specially organized by valance electrons, noticed that among the elements they had identified, toxicity decreased toward the top, and flammability decreased toward the right (Leslie, 1980). Fluorine was the refrigerant they were seeking. It was an idea that they eventually turned into a non-toxic, non-flammable refrigerant, dichlorodifluoromethane, the first of many chlorofluorocarbons or CFCs (Leslie, 1980).

A brilliant engineer and chemist, Midgley saved lives by developing what he thought was a safer refrigerant. He also inadvertently started two major health crises—lead poisoning and the destruction of ozone in the stratosphere (Bryson, 2004)

Lead was a well-known toxin, even in 1921. By 1962, Rachel Carson drew attention to toxins in the environment, and by 1965, Dr. Claire Patterson published an article on chronic lead exposure (Nriagu, 1990; Tilton, 1998). Subsequently, the U.S. Environmental Protection Agency phased down lead from 1974 to the ban of it in on-road vehicles in 1996 (Newell & Rogers, 2003). Less leaded fuel led to less in the air and in people's blood (Nriagu, 1990).

Unlike lead, it was years later that scientists begin to understand the effects of CFCs. In

1974, two chemists brought attention to the effect of CFCs on the ozone layer. Just over 10 years later, another research team discovered a hole in the ozone layer (Nunez, 2019). Individuals began avoiding aerosol products, and sales declined (Editorial Board, 2019). A work sheet from the 1990s asks students "to develop their own personal action plans to reduce CFCs…," which is oddly prescient of the current climate problem (*"Hole"y Ozone! It's the CFCs!*, 1991). Protecting the ozone layer became a part of the EPA's duties by Congress (Editorial Board, 2019). By 1987, United Nations member countries ratified the Montreal Protocol, which phased out ozone-depleting substances (Nunez, 2019). Over 30 years later, NASA documented that Antarctic depletion was down by 20% since 2005, and the United Nations projects the polar regions should recover by 2060 (Nunez, 2019).

This is a simplistic explanation of complex global problems and solutions. However, in the 1920s, the world had two new problems—leaded fuel and ozone depleting gases. By the 1970s and 1980s, the world had new solutions that continue to be implemented—lead phase out and the Montreal Protocol. Actions ranging from individual to international have successfully addressed global environmental dilemmas, which brings the conversation to the most pressing quandary of our time.

Climate change reached the desk of President Johnson in 1965. His Science Advisory Committee presented him with a report called *Restoring the Quality of Our Environment* which directly addressed the concerning rise in carbon dioxide from fossil fuels in the atmosphere (Nuccitelli, 2015). Despite a warning 50 years ago and continued warnings since, carbon emissions have continued to rise (IPCC, 2018; *Juliana et al. V. United States of America et al.*, 2020).

Climate change differs from lead and CFCs. The causes are varied, including cars, cows, deforestation, farms, airplanes, and decomposing waste. The problem itself is invisible, not easily imagined as a disconcerting hole in the sky or smoggy city. The solution in 1965 for climate

change was not as easy as a substitution like unleaded gas and a catalytic converter (Editorial Board, 2019). Climate change solutions are as diverse as the sources of carbon.

Thus, scientists continue to research the causes and effects of climate change. Governing bodies draft and re-draft, enter and exit agreements, and the carbon levels in the atmosphere continue to rise. According to the Intergovernmental Panel on Climate Change, the next 10 years are pivotal (IPCC, 2018). The effects of climate change are present and intensifying. Increasing frequency of extreme weather events, rising ocean, and diminishing biodiversity are only a few of the risks the 2018 report details (IPCC, 2018). The research and negotiations continue. Now, substitutions are available too. Solar and wind have advanced technologically and dropped in price. Electric cars and ride matching services are accessible in ways they were not in 1965, but time is short, and wide scale shifts must occur.

Climate change is more than an issue of individual behavior. It is a political problem that liberals and conservatives debate. It is a financial problem that corporate interests contest. Individuals contribute to climate change within the wider political and financial system in which they live.

On the political front, conservatives and liberals conceptually disagree about the role of humans in the environment. Conservatives are more inclined to place humans at the top of a moral hierarchy, where they are in a place to use and consume nature (Lakoff, 2002). Additionally, conservative ideology places financial markets as the ultimate arbiter of worthy enterprises (Lakoff, 2010). Interventions that would alter the market to favor environmentally conscious technologies or business would disrupt the market (Lakoff, 2010). Furthermore, people depend on values and other factors to form opinions in complex situations. Thus, reference groups like political parties or elites also inform people's decisions on climate change (Bolsen et al., 2019; McCright & Dunlap, 2011).

On an economic front, if governments adopted policies to limit global warming to 2° C, the value of stranded fossil fuel assets would be in the trillions of dollars (Mercure et al., 2018). Fossil fuel and cement production organizations are also major contributors to global emissions, accounting for over 60% of world greenhouse gas emissions between 1751 and 2010 (Heede, 2014). Although oil and gas companies recognize climate science, many still maintain memberships in organizations that promote climate denial or obstruct actions to slow climate change (Grasso, 2019). Thus, major corporations present two more challenges to transitioning to a low carbon economy. They are still an influential component of the world economy, and they have lobbied to stay in that position with misleading claims without substantially shifting their operations away from the production of carbon dioxide.

However, technology exists to make the shift. The deficit is no longer primarily in known alternatives to fossil fuels. Social sciences have explored the realm of behavior change and its components. Theory of Planned Behavior, Value-Belief-Norm theory, and theory of intrapersonal behavior are among a few of the models used to understand behavioral decisions individuals make. They incorporate attitudes, subjective norms, perceived behavioral control, values, and habits. Yet, human behavior is still a main and least understood cause of climate change (Gifford & Nilsson, 2014).

Theory of Planned Behavior identifies attitudes, subjective norms, and perceived behavior as predictors to behavioral intention (Ajzen, 1991). It extends the theory of reasoned action by adding a measure of whether individuals think they are able to do a behavior, self-efficacy, from the work of Bandura (Ajzen, 2020; Bandura, 1977; Fishbein & Ajzen, 2011; Madden et al., 1992). In a review of energy behavior studies, 39% of the studies used it, making it the most commonly used behavioral theory (Klöckner, 2013).

Understanding individual human behavior is one piece of the puzzle, as is

understanding the relationship between individual behavior, non-profits, businesses, governments, and other organizations. Reducing the use of aerosols was an individual solution to CFCs. Environmental organizations distributing information on which products to avoid and organizing protests were non-governmental or non-profit solutions (Cook, 1990). Businesses shifting to non-CFC propellants was a business solution, and the Montreal Protocol was a governmental solution.

It is 2020, a year when flights were grounded and many schools transitioned to online education. Drastic changes are possible, and unlike a pandemic, this is a transition we have had time to plan. This dissertation explores communicating changes to personal behavior, including activism behaviors, that could mitigate climate change. It seeks to answer questions about the effectiveness of individual intervention in addition to examining the individual socio-demographic and psychological factors that influence behaviors. Finally, it investigates when individuals defer to other organizations for behaviors that they do not pursue themselves.

Background and Literature review

Climate Change Communication

Climate change is a "wicked problem," or sometimes even referred to as a "super wicked problem." It is a time-constrained problem where the people causing it are also solving it. An authority with jurisdiction is weak or non-existent, which is related to the another characteristic, "policy responses discount the future irrationally" (Levin et al., 2012). The problem is difficult to define. Solutions are implemented in an iterative process to address aspects of the original problem, but the solutions leave lasting effects, including additional problems that require additional solutions. The problem itself is a symptom of a bigger problem (Rittel & Webber,

1973). A climate change "solution" may require more of a mobilizing narrative in the direction of sustainability with inclusive and diverse approaches (Hulme, 2009; Jerneck, 2014).

If addressing climate change is complicated, then so is communicating climate change. The problem itself lacks immediacy. Urgent issues, like securing food and earning money for daily survival, are a higher priority (Markowitz & Shariff, 2012). Furthermore, in countries like the United States, air conditioning, cars, and other widely available comforts can insulate people from some of the effects of climate change (Moser, 2010). With so many competing priorities, the transformative path to sustainability needs to meet people where they are but lead somewhere different. Altering communication is a way to diverge from the status quo.

"Did you say please?"

The framing of a question can affect the answer. At one time, behavior change strategies assumed that if people understood the problem, then they would undertake the solution (Bak, 2001). However, anyone who has tried to make a New Year's resolution knows that change is difficult. Despite calls for more education on environmental issues, many studies have provided evidence that knowledge alone is insufficient to change behavior on a broad scale (Bak, 2001; Hobson, 2002).

Communication is still an important but complex aspect of addressing climate change. Informing people is only one purpose of communication. Information engages people's minds. However, communication can also move people to action, motivating them to translate knowledge to behavior. In an even broader role, communication can motivate social change, altering norms and lifestyles (Moser, 2010).

Presenting information in a relevant frame provides an audience with a perspective for a concept or problem. Frames can be verbal, but they can also involve imagery, venue, messenger,

and other aspects of presentation and delivery (Moser, 2010). Frames can increase the salience of the message or conjure emotion (Powell et al., 2015). Therefore, choosing a frame is an important decision. For example, public messaging on climate change tends to reflect moral foundations that more strongly resonate with liberal people (Feinberg & Willer, 2013). Framing messages to align with the moral foundations of the audience has resulted in behavior changes that generic or misaligned messages have not (Feinberg & Willer, 2013; Kidwell et al., 2013; Wolsko et al., 2016).

Say that again with purity.

A commonly cited definition of the moral domain is "prescriptive judgments of justice, rights, and welfare pertaining to how people ought to relate to each other," (Turiel, 1983). However, morality is broader than the individual relationships people have with one another. Groups and organizations have roles as well (Graham et al., 2013). Moral foundations theory (MFT) was developed to encompass moral languages from many cultures (Graham et al., 2013). Harm, fairness, loyalty, authority, and purity represent the five dimensions in MFT. Whereas harm and fairness reflect individual relationships, loyalty, authority, and purity reflect more of the relationships that bind people within society (Graham et al., 2013).

Unlike Theory of Planned Behavior or value-belief norm theory, it is not a theory of behavior change, but it can fit into these theories as moral norms or values, which can influence decisions people make (Botetzagias et al., 2015; Jansson & Dorrepaal, 2015; Kaiser et al., 2005; Kaiser & Scheuthle, 2003; Rivis et al., 2009). Studies have focused on purity and harm as having particular relationships to environmental behavior and political party (Dawson & Tyson, 2012; Dickinson et al., 2016; Jansson & Dorrepaal, 2015; Koleva et al., 2012). People with liberal ideology are more likely to value harm and fairness foundations, whereas people with conservative ideology are more likely to value authority, loyalty and purity or all five

foundations more evenly (Graham et al., 2009; Koleva et al., 2012).

Given the role morality and political ideology play in climate change, moral foundations are an area researchers are exploring (Day et al., 2014; Feinberg & Willer, 2013; Koleva et al., 2012). It appears that political conservatives and liberals disagree on whether environmental issues are an issue of morality at all (Currie & Choma, 2018; Feinberg & Willer, 2013). However, political liberals and conservatives may be speaking different moral languages. If that is the case, then it could be an opportunity for more effective communication and more effective climate change mitigation strategies. Morality can influence attitudes, and understanding climate change from a moral perspective can influence behavior (Luttrell et al., 2016; Markowitz, 2012; Markowitz & Shariff, 2012).

Behavior Change

Behavior change is a necessity to mitigate climate change. However, it is challenging to achieve and continue over time (Nisa et al., 2019). Additionally, behaviors can be implemented with different intents and effects. Impact-oriented behaviors have a large and measurable impact, regardless of intention (Stern, 2000). Examples could include having one fewer child, not flying for transportation, or opting to walk instead of drive (Wynes & Nicholas, 2017). Financial or health reasons could be the motivation, rather than environmental impact, and in fact, these motivators seem to be more common for energy conservation (Whitmarsh, 2009). Intent-oriented behaviors, on the other hand, intend to benefit the environment, regardless of impact. These behaviors may prevent small amounts of carbon or more strongly affect other aspects of the environment, like reusing a water bottle instead of using paper cups.

The distinction between the two is not only relevant to behaviors' differing impacts on greenhouse gas production, it also affects predictors of the behaviors (Coelho et al., 2017;

Gatersleben et al., 2002; Poortinga et al., 2004). Studies focusing on impact-oriented behaviors focus more on structural, socio-demographic, contextual factors like income, urbanity, habit, perceived costs, or number of people living in a household (Enzler & Diekmann, 2019; Whitmarsh, 2009). Studies focusing on intent-oriented behaviors are more likely to focus on values and find that morality and environmental concern play a stronger role (Enzler & Diekmann, 2019; Whitmarsh, 2009).

These disparate definitions lead researchers to different conclusions. The predictors affect the logical solutions. If cost and income are important, then financial incentives might be solutions, whereas if morality is important, then re-framing the problem might be a solution (Enzler & Diekmann, 2019). They may also contribute to a gap between people's reported values and behaviors, as well as a gap between people's behaviors and measurable impacts (Blake, 1999; Csutora, 2012; Kollmuss & Agyeman, 2002; Moser & Dilling, 2011; Tabi, 2013). With environmental aspects to so many daily decisions, people may choose behaviors that are convenient but not effective (Csutora, 2012; Tabi, 2013).

Carbon calculators are one method for communicating environmental information and the most impactful changes. They provide individualized feedback for users on the carbon generated by their lifestyle. They can also put carbon production or resource consumption in context of the available resources on Earth (Franz & Papyrakis, 2011; Jones & Kammen, 2011; Lambert, 2013). However, few studies have examined their effectiveness in changing behavior or reducing individuals' carbon footprints. See appendix A for a review of studies. Since information is not sufficient to change behavior, a calculator alone is unlikely to be successful (Bak, 2001; Schultz, 2002; Sturgis & Allum, 2004). However, calculators are easy to combine with other interventions, like norms and moral foundations, which have some evidence supporting their use in behavior change (Botetzagias et al., 2015; Brook, 2011; Feinberg & Willer, 2013;

Goldstein et al., 2008; Kidwell et al., 2013; Mallett et al., 2013; Toner et al., 2014; Wolsko et al., 2016).

Evidence indicates that interventions are more effective in combinations, facilitating the behavior in more than one way. For example, information or justifications pair most effectively with cognitive dissonance and prompts (Osbaldiston & Schott, 2012). Thus, combining information in the form of a calculator could be effective paired with a moral foundation intervention, which could appeal to moral norms or communicate how pro-environmental behavior fits into individuals' moral beliefs.

A Ways to Go

Social researchers have made considerable progress in identifying predictors of behavior, and there is still much to learn. The Theory of Planned Behavior explains about 39% of the variance in intention but 27% of the variance in actual behavior (Armitage & Conner, 2001; Bamberg & Möser, 2007). One study estimates reported behavior and actual behavior share roughly 20% of their variance (Kormos & Gifford, 2014). Another study estimates the difference between shared variance closer, at 22.5% (Yuriev et al., 2020). Although Theory of Planned Behavior predicts intention, usually, researchers are more interested in behavior, which is still difficult to predict. Either researchers have considerable work to do, or they are reaching the theoretical limit (Ajzen, 2011).

Measuring changes in behavior is challenging too. Many studies depend on self-reported behavior because it can be collected in relatively simple survey instruments. Yet, participants can still forget or misreport their behavior. Even in the same household, it can be difficult to include behaviors of every person (Gifford & Nilsson, 2014). Objective measures of behavior or outcomes provide more useful data, but observing behavior requires more organization and must seriously

consider privacy concerns. Furthermore, accessing other objective measures such as bills, utility data, or mileage often can also be difficult if they are available at all. However, objective measures of behavior or behavioral impact provide a more complete picture of the behaviors that participants perform and their effects.

If not you then who?

Individual behavior is one level of climate action, but not all actions are most effective at the individual level. Attitudes, self-efficacy, norms, and other factors can only go so far to address availability of resources, time, or services that facilitate environmental behaviors. Some impactful processes are removed from individuals' direct control, such as energy production and food processing (Amel et al., 2017). Certainly, a response must be as multi-faceted as the causes.

Returning to CFCs, environmental change communicators, non-profits, and extension agents would be hard pressed to produce the effects of the Montreal Protocol through individual behavior changes. However, organized actions of individuals in environmental groups, for example, played a role (E. Cook, 1990). Considering the most effective level of action and the role individuals play is important too, and one aspect of determining and influencing levels of action is considering how people assign responsibility.

The concept of responsibility has two basic parts—causal and treatment. Causal responsibility is accountability for the source of the issue. Treatment responsibility is accountability for mitigation (Iyengar, 1996). The attribution of responsibility reflects political and cultural beliefs as well as framing of the situation (Iyengar, 1996). Beliefs about responsibility also affect whether people attribute responsibility to individuals or society and who they think should fix it (Iyengar, 1996; Jang, 2013; Kent, 2009; H. Kim et al., 2019; S.-H. Kim, 2015).

Many options for distributing responsibility may work to reduce carbon emissions. In the

absence of voluntary action by businesses or governments, individuals may have a role in collective action expressing the necessity of partners that affect the climate in ways individuals cannot. Individual roles in collective actions can include voting, contacting governmental representatives, donating to organizations, signing a petition, and protesting, among others. Additionally, individuals can represent these views within their own organizations—work, schools, churches, non-profits, etc. The roles of all these organizations are crucial for their own future, that of their members, and all of humanity.

Research Objectives and Overview of Studies

The following studies investigate sociological, psychological, and demographic elements of specific pro-environmental behaviors. The first article covers a longitudinal study in which participants completed a carbon calculator with an intervention drawing on one of two moral foundations interventions or a control. The study aimed to provide useful applied research to the local utility while comparing an objective measure of behavior change with self-reported measures of energy, transportation, and food. This article extends research on the role of morality in environmental behavior, and explores the effects of congruent and incongruent message framing on behavior, measured subjectively and objectively. The results support evidence that measuring intentions alone does not accurately reflect environmental impact.

Considering the results of the first study, in which participants adopted few new behaviors, the second article dives deeper into the predictors of specific behaviors in four categories—transportation, energy, food, and activism. For each behavior, participants responded with their level of adoption. The analysis explores relationships between adoption levels and moral foundations, guilt and shame proneness, and other common factors, such as attitudes and self-efficacy. This article contributes to a growing body of research on predictors as

they vary between behaviors.

The third article extends the exploration of predictors for specific behaviors by following up with participants who reported that they could adopt behaviors but have not. It examines who, in the participant's opinion, is responsible for addressing an issue when the participant has chosen not to adopt a behavior. The second and third articles further investigate the role of moral foundations in behavior change, and add a measure of guilt and shame proneness as well. Finally, the third article bridges between individual actions and the responsibilities of businesses, non-profits, and governments as perceived by the participants.

CHAPTER 2

MORAL FOUNDATIONS IN ENVIRONMENTAL BEHAVIOR: OBJECTIVE AND SUBJECTIVE MEASURES

Highlights

- Carbon calculator and morality-based interventions did not reduce electricity use.
- Transportation and electricity-related behaviors increased slightly.
- Harm messaging was more effective with participants with higher moral foundations.

Abstract

Influencing human behavior to reduce carbon emissions is notoriously difficult. This study tested the effectiveness of moral-foundations-based interventions combined with a carbon calculator on nine self-reported measures and one objective measure of behavior. Participants reported slightly increased electricity-related behaviors over the study period. However, electrical consumption in the household did not change. Moral foundations messaging had little influence on self-reported behavior and no influence on electrical consumption.

Keywords

Pro-environmental behavior, moral foundations, carbon calculator

Introduction

As human behavior sends Earth systems toward planetary boundaries, immediate action is required to change the course (Rockström et al., 2009). Rockström et al. (2009) have identified

nine boundaries, for three of which humanity has already exceeded the safe operating space. Acting on even one of the planetary boundaries, climate change, has proven challenging. In the United States, political liberals and conservatives disagree on whether it is even occurring and especially whether humans have caused it (McCright et al., 2016). The disagreement extends beyond the interpretation or validity of data. The scientific community already agrees. Ninety-seven percent of climate scientists agree human-caused global warming is occurring (J. Cook et al., 2016).

A social consensus is more elusive (Hoffman, 2012). People more closely identify with others in their self-identified group, and the partisan gap has widened on global warming since the late 1990s (Dunlap & McCright, 2008; Kahan, 2013). Conservative think tanks, political elites, and the fossil fuel industry published documents and funded advertisements calling climate change into question, which pushed conservatives and liberals in the United States further apart (Grasso, 2019; Jacques et al., 2008; McCright & Dunlap, 2003). These political identities continue to be important in Americans' understanding of climate change. When they become salient, people are less likely to believe in anthropogenic climate change and support government action, especially among conservatives (Unsworth & Fielding, 2014).

Within the political divide is a moral divide in the foundations on which Americans draw to make decisions (Graham et al., 2009). Basic differences in moral beliefs on social inequities, parental authority, solutions to crime, and sanctity of life play a role in American politics (Graham et al., 2009; Lakoff, 2002). Personal moral foundations may intuitively influence how people interpret environmental information as well. This study further explores the role of moral foundations in facilitating changes in nine self-reported and one objective measure of environmental behavior.

Morality

Morality is commonly defined as, "prescriptive judgments of justice, rights, and welfare pertaining to how people ought to relate to each other," (Turiel, 1983). However, limiting morality to harm and fairness leaves out other moral concerns, such as respect, loyalty, and purity (Graham et al., 2009).

The moral landscape, in all its complexity, is tied to environmental behavior. In the Theory of Planned Behavior, moral norms serve as a precursor to attitudes or intentions (Jansson & Dorrepaal, 2015; Kaiser et al., 2005; Kaiser & Scheuthle, 2003). When a person ties an attitude to morality, the attitude is more likely to predict intention and resist change (Ajzen, 1991). Yet, political conservatives are less likely than liberals to perceive environmental behaviors as a moral issue (Currie & Choma, 2018; Feinberg & Willer, 2013). Perhaps this is reflective of environmental messaging in the United States, which does not reflect moral foundations commonly held by people who identify as conservative. In the United States, environmental messages primarily reflect individualizing foundations, which appeal more to liberal audiences (Feinberg & Willer, 2013).

Moral Foundations Theory (MFT) provides a framework for classifying and studying moral messaging. It identifies five foundations. Two foundations appeal more to liberals—harm/care and fairness/reciprocity. These are sometimes referred to as individualizing foundations because they focus on rights of individuals and personal welfare. Three binding foundations appeal more to conservatives: authority/respect, in-group/loyalty, and purity/sanctity (Graham et al., 2009). However, some research also shows conservatives value all foundations more equally than liberals (Clayton et al., 2013; Dawson & Tyson, 2012; Feinberg & Willer, 2013; Jansson & Dorrepaal, 2015; Kidwell et al., 2013; Koleva et al., 2012; Markowitz &

Shariff, 2012; Nisbet et al., 2012; Wolsko, 2017; Wolsko et al., 2016).

While moral beliefs are resistant to change, with careful framing people can tie attitudes to existing morality (Luttrell et al., 2016). Thus, if environmental messaging resonated with people's existing morals, it could be more inclusive of people across the political spectrum. Inclusive messaging could be vital to addressing climate change because people who view climate change as a moral issue are more likely to act (Markowitz, 2012).

Morality & Behavior

Behavior change is vital when it comes to addressing environmental concerns. Yet, it is difficult to implement and sustain (Nisa et al., 2019). Frequently, studies use self-reported data due to the difficulty of measuring behavior objectively. However, the lack of behavioral data may distort results because people frequently forget or misrepresent self-reported behavior (Kormos & Gifford, 2014).

Additionally, people often adopt environmental behaviors that do not significantly affect their environmental footprint (Csutora, 2012; Tabi, 2013; Whitmarsh, 2009). For research purposes, behaviors are often categorized by impact or intent. Whereas impact-oriented behaviors focus on the outcome over the intention, intent-oriented behaviors reflect the purpose over the outcome. Impact-oriented behaviors have a stronger relationship to environmental impact by definition, and intent-oriented behaviors tend to have a weak relationship. For example, Enzler and Diekmann (2019) found a correlation between pro-environmental behavior (PEB) and emissions of $r = -0.14$ (Enzler & Diekmann, 2019). Income and household size tend to predict emissions better than PEB (Chen et al., 2016; Gatersleben et al., 2002; Poortinga et al., 2004). However, environmental concern or values tend to predict behavior better than emissions (Enzler & Diekmann, 2019; Whitmarsh, 2009).

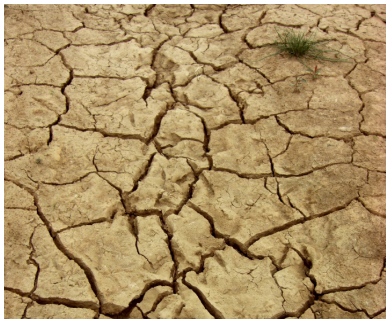
Yet, moral foundations are a possible inroad to behavior change as they have been associated with both intentional and actual behavioral changes. Harm/care moral foundations or compassion are believed to predict intentions to prevent or mitigate climate change (Dawson & Tyson, 2012; Dickinson et al., 2016; Jansson & Dorrepaal, 2015; Koleva et al., 2012). For example, one study found that when messages were congruent to the moral foundations of the audience, the weight of curbside recycling increased (Kidwell et al., 2013). Likewise, conservatives receiving a binding message, aligned with their moral foundations, donated more money to the Environmental Defense Fund than in the individualizing condition. Their donations even surpassed the levels of liberals (Wolsko et al., 2016). Reframing communications in line with a purity foundation may reduce the disparity between the moral perceptions of environmental behavior between political conservatives and liberals (Feinberg & Willer, 2013).

Study

Reframing environmental messaging to reflect moral foundations may be one way to help people understand how environmental concern and behavior align with their values (Feinberg & Willer, 2013; Kidwell et al., 2013; Wolsko et al., 2016). Carbon calculators convey personalized environmental information that could inform action. Users input information such as household size, miles driven, and types of food eaten to receive an estimated carbon dioxide produced by their lifestyle, enabling users to make informed decisions. Calculators let consumers benchmark their consumption against sustainable levels, other consumers, or worldwide averages. Calculators can also provide consumers with a way to internalize external costs of behaviors (Jones & Kammen, 2011). However, few researchers have found a way to push the communication of carbon footprints beyond information to behavioral change. Combining calculators with other techniques has shown some success, such as a 14% decrease in electrical

consumption based on self-reported bills or 10% reduction in ecological footprint based on a pre- and post-test in an online calculator (Jones & Kammen, 2014; Lambert, 2013). Few studies have reported effective carbon reduction from the communication of carbon footprints without an associated energy challenge or competition using a suite of behavior change strategies (Büchs et al., 2018).

Combining a carbon calculator with environmental messaging that reflects personal moral foundations may be one way to help people understand how environmental concern and behavior fit their values (Feinberg & Willer, 2013; Kidwell et al., 2013; Wolsko et al., 2016). This study extended previous research by examining the link between moral messaging and carbon calculator feedback with behavior.


These images and texts are examples from purity, harm, and control interventions (from left to right).

Figure 1: Purity intervention example
"Deforestation for food production turns once pristine wilderness into barren, depleted fields. Runoff from farms contaminates the water we drink. Even the livestock we eat deposit fecal matter in pristine mountain streams polluting recreational and drinking water."

Figure 2: Harm intervention example
"Deforestation for food production has led to the erosion of topsoil, making formerly fertile land into useless deserts. The result is barren soil across the world, making it harder to produce food, resulting in famine and starvation."

Figure 3: Control intervention example
"Deforestation for food production depletes soil and leads to erosion. Food becomes harder to produce in barren soil, and yields decline. Furthermore, runoff from farms and ranches enters ponds, rivers, oceans, and seas."

Participants answered questions for a measure of their personal moral foundations, and they received a randomly assigned intervention, which was congruent, incongruent, or neutral in relation to their personal moral foundations. The interventions featured binding, individualizing, and messages without moral content (control) in conjunction with an online carbon calculator. Images and messages were adapted from a study by Feinberg and Willer (2013) on communicating climate change. Additional relevant images came from the Socio-Moral Image Database, which rates images on several factors including arousal ("calming" to "exciting") and relevance to the five moral foundations (Crone et al., 2018). Thus, images could be selected for their scores on perception of morality and relevance to the selected moral foundations. Examples are in Figures 1-3, and a complete set of images and messages can be found in Appendix B.

Given that not all environmental behaviors lead to measurable reductions in carbon emissions, the behavioral response variables in this set of studies represented three of the areas of the greatest carbon impact for most people: transportation, food, and electricity (Lorek & Spangenberg, 2001; Markle, 2013). Every week, participants self-reported behavior. The study also measured electricity consumption as an objective measure. Although weekly readings were collected, monthly readings had fewer missing values and were used for statistical analysis. Utility data combined with self-reported data helped identify any disparity between actions people took and the effect of those actions.

The results of this study allow for the comparison of an objective and self-reported measure of electricity-related environmental behavior. Furthermore, the study looks for the effect of congruent and incongruent messaging on behavior. Results also reveal differences between the effects of moral foundations appeals on specific categories of behavior.

Questions and Hypotheses

Q1. Which combination of moral foundations-based interventions and carbon calculator is most effective at reducing carbon?

h1.1. Carbon calculators and moral foundations messages will be more effective at changing people's behavior than a calculator and control message (Jones & Kammen, 2014; Lambert, 2013; Osbaldiston & Schott, 2012).

h1.2. Congruent messages will increase carbon-reducing behavior and reduce carbon emissions, whereas incongruent messages will either have no effect or decrease carbon-reducing behavior (Day et al., 2014; Kidwell et al., 2013; Wolsko et al., 2016).

Q2. Are MFT appeals more effective on specific types of behavior?

h2.1. MFT appeals will be have a greater effect on electricity behaviors than on food or transportation (Poortinga et al., 2003).

h2.2. Self-reported measures of behavior are more likely to show change than the objective measure (Csutora, 2012; Tabi, 2013)

Materials and Methods

Experimental Design

The target audience was Logan City utility customers, which has approximately 14,000 utility payers. Utility bills were an accessible objective measure of carbon consumptive behavior. The study targeted people living where they are also paying bills. These participants had an

incentive to reduce energy because they would receive a direct return on investment through reduced bills.

The study ran twice, once in fall and once in spring. Recruitment in both studies used a modified Tailored Design method, which has a 43% response rate in the push-to-web design (Dillman, 2015; Dillman et al., 2014). Since the first study—recruiting through mail only and requiring follow-up responses online—would likely lower the response rate, invitations went to 1,200 households to obtain a sample of 390 participants with a minimum of 100 participants in each important group (Israel, 1992). Using the city's meter reading system, 20 routes were selected in a stratified random sample proportional to the total number of households in each of the city's billing routes and cycles.

After Institutional Review Board (IRB) approval, households received up to four mail invitations to join the study. Since the calculator was only available in English, the invitations were also only available in English. Of the invited households to the first study, 146 completed the demographic survey and 106 completed the carbon calculator. The city provided the readings used for billing once a month, in which city employees manually read any meters not available through remote reading. In addition, the city pulled weekly readings for the study without filling in missing readings. Research assistants collected the missing weekly meter readings unavailable from the city's remote service over seven weeks, November 7-December 19, 2018.

Though the study was completed, the first iteration of the study failed to receive a response rate that would detect a possible effect. The poor response was likely due to the recruitment through mail, which forced people to input the study's web address on an Internet-connected device. Mail recruitment also meant that a portion of the people invited to join the study had no Internet access and could not participate.

In the spring, the IRB approved a revised study that recruited via email in addition to mail. The list of potential participants was narrowed to people with an email on file with the city and was further narrowed to households from which the city could pull remote readings. Every meter route had households that met both criteria. The largest number of available participants with email addresses and remotely read meters in 20 representative routes were selected: 1,899 households in total. From the invited households, 341 took the demographic survey and 215 completed the carbon calculator. Like the first study, seven weeks of readings and corresponding self-reported behavior were collected. The second study ran from February 19 to March 31, 2019.

In the invitation, designed based on a modified version of the Tailored Design Method, participants were directed to an online survey via a short URL (Dillman et al., 2014). All participants completed demographic, moral foundations, and self-reported behavior questionnaires assessing their behavior over the past week.

Participants received a $2 bill with the first invitation. According to Dillman et al. (2014), financial incentives upfront increase the response rate. Another study showed a survey with a $2 incentive received a 56% response compared to a 44% response with an incentive as a chance to win $250 (Tamayo-Sarver & Baker, 2004). Another meta-study found no statistical effect from rewards contingent upon completion (Church, 1993). However, after a poor response rate in the first iteration of the study, participants in the second study were eligible for a drawing for one of

	Cycle						
Study Number	100	200	300	400	500	600	700
1	9	2	5	3	5	4	3
2	36	27	17	30	21	25	20

Table 1: Participants by cycle and study number for electricity behavior

five $100 gift certificates upon completion in addition to the $2 incentive by mail.

After the recruitment period had ended, participants completed a carbon calculator combined with a randomly assigned purity/sanctity message, harm/care message, or control message. While the interventions involved specific moral foundations, the control group received corresponding messages without moral content. Participants subsequently received weekly reminders to report their behavior over the past week. The intervention targeted carbon emissions generated through food, transportation, and household electricity, which account for the majority of individual carbon consumption (Jones & Kammen, 2011; Markle, 2013). To test the interventions, participants' household electricity consumption was measured before and throughout the study. See Appendix C for a full list of variables and Appendix D for the behavioral questions.

Carbon Calculator

Participants completed the CoolClimate Carbon Calculator operated by University of California, Berkeley, which is used by individuals and environmental groups, including The Nature Conservancy. Feedback consisted of four parts. Participants saw a bar graph of their carbon consumption in the areas of travel, home, food, goods, and services throughout the process. Simultaneously, readouts of tons of carbon dioxide and a normative emoji reflected how well the participant was doing. The appearance of the emoji changed from angelic to crying, depending on the performance of participants. The final results also provided a list of actions a person could take to reduce their carbon footprint.

Moral Foundations

The Moral Foundations Questionnaire (MFQ 30) scores an individual's moral

foundations through six questions on each foundation for a total of 30 questions (Graham et al., 2011). Each of the six questions is on a Likert scale from zero to five. The harm/care and purity/sanctity foundations were represented through environmental messages and images accompanying the carbon calculator feedback. See Appendix E for the full moral foundations questionnaire.

Results

First, participants and non-participants (studies 1 and 2, combined) were compared to identify differences between the groups. The median age of participants was 29, older than the median age in the city of 24 (U.S. Census Bureau, 2016). Median income and gender identification were both similar to census data. The median income was in the $20,000-$39,999 range, 48% identified as female, 51% identified as male, and 1% identified with a gender not listed on the survey. In the city of Logan, the median income is $36,256, and 50% identify as female, while 50% identify as male (U.S. Census Bureau, 2016).

Participants in the studies were less diverse; 92.4% white compared to 75.4% in city who identifies as white alone (U.S. Census Bureau, 2016). The majority of the difference was accounted for by fewer Hispanic or Latinx participants, 2% versus 15.5% in the city's population (U.S. Census Bureau, 2016). The calculator was only available in English, and therefore, the survey was also in English. The absence of other language options could have influenced the lack of diversity. Participants were also more highly educated than the city population with 95% of study participants having education beyond a high school diploma, compared to 70% in the city (U.S. Census Bureau, 2016).

Additionally, participants were more likely to have voted in the 2016 presidential election than the average resident, 77% versus 47% of voting age population (Cache County,

Utah, 2016; U.S. Census Bureau, 2016). Voting in the election also differed from the city's population. Fewer participants voted for Trump, 21% versus 34%, and McMullin, 22% versus 29%, than the city population. Slightly more voted for Clinton, 30% versus 28%. The largest difference was in "other" candidates, 26% versus 10% (Cache County, Utah, 2016). It is possible that some of the votes for "other" were people who preferred not to answer the question.

Comparing participants and non-participants

Monthly electricity consumption of zero and above 3,500 kWh per month were dropped since zero would indicate an unoccupied property. A spot check of high meter readings included multiple mobile homes connected to one meter and other properties that were not comparable to single family residences. The range on the non-participants is much wider (bother higher and lower) than the participants. The larger range is likely because non-participant meters include empty houses, houses in construction, meters measuring multiple households, and some commercial properties. Additionally, the sample size was much larger since it included any meter in the billing cycle (geographic area) with reported data.

Next, a Kolmogorov-Smirnov (K-S) test evaluated the likelihood of two samples coming from the same population for the first month's electricity consumption, before the intervention. K-S tests evaluate differences in dispersion and shape. To treat the sample as representative of the population, the test would need to fail to reject the null hypothesis that the two samples were drawn from the same distribution. Comparing study one and two participants, a p-value of 0.11 failed to reject the null hypothesis that the two groups could have been drawn from the same population. However, there is evidence that participants and nonparticipants may not be representative of a common population in both study 1 ($p=0.06$) and study 2 ($p=0.03$). Issues with the range of non-participants, previously discussed, could have contributed to these differences.

Additionally, recruitment methods could contribute, such as email recruiting favoring people with Internet and the English-only materials favoring English speakers. See Figure 4 for the distributions.

Since the K-S test indicated possible differences between the participants and non-participants. Two-way factorial Analyses of Variance (ANOVAs) checked for a difference in means between study 1 and study 2 participants and non-participants (Figures 5-6). The first month's electrical consumption was the dependent variable, accounting for study number and neighborhood, which is indicated by the billing cycle variable. With the addition of cycle (p=0.00) and study number (p=0.00), the difference between participants and non-participants was no longer significant (p=0.72). Cycle may encapsulate differences between residence sizes or construction years in neighborhoods. The study number's significance may represent a seasonal effect in temperature and day length. The cycle and study number, which were significant, continue in future models.

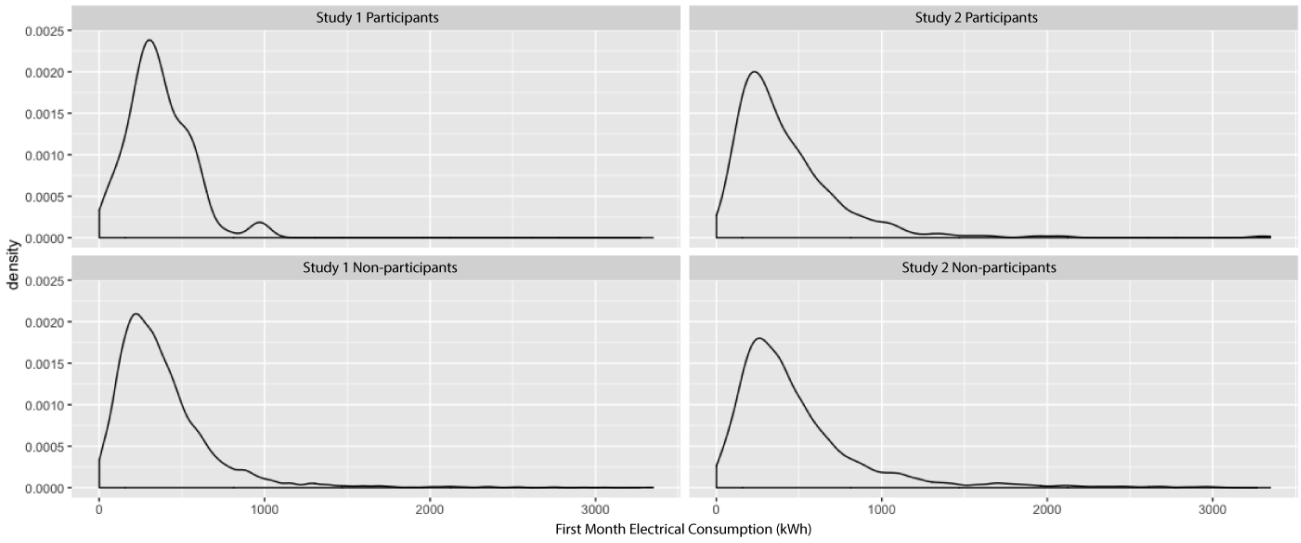


Figure 4: Population distributions

The results of the Kolmogorov-Smirnov for participants and non-participants in studies one and two indicate potential differences between that the first month of electricity consumption in participants and non-participants.

Energy Consumption Differences Among Participants

An Analysis of Covariance (ANCOVA) for each intervention examined the effect of a participant's personal moral foundations and assigned intervention on electricity consumption.

The response variable was a log ratio of electricity consumption for the week before the intervention over the average of weeks four and five (four or five if one of the weeks was missing). The independent variables were personal moral foundations and an assigned intervention while controlling for cycle and study number. The results show no significance of the intervention, moral foundations, or the interaction of the two on the ratio of pre-and post-intervention energy consumption.

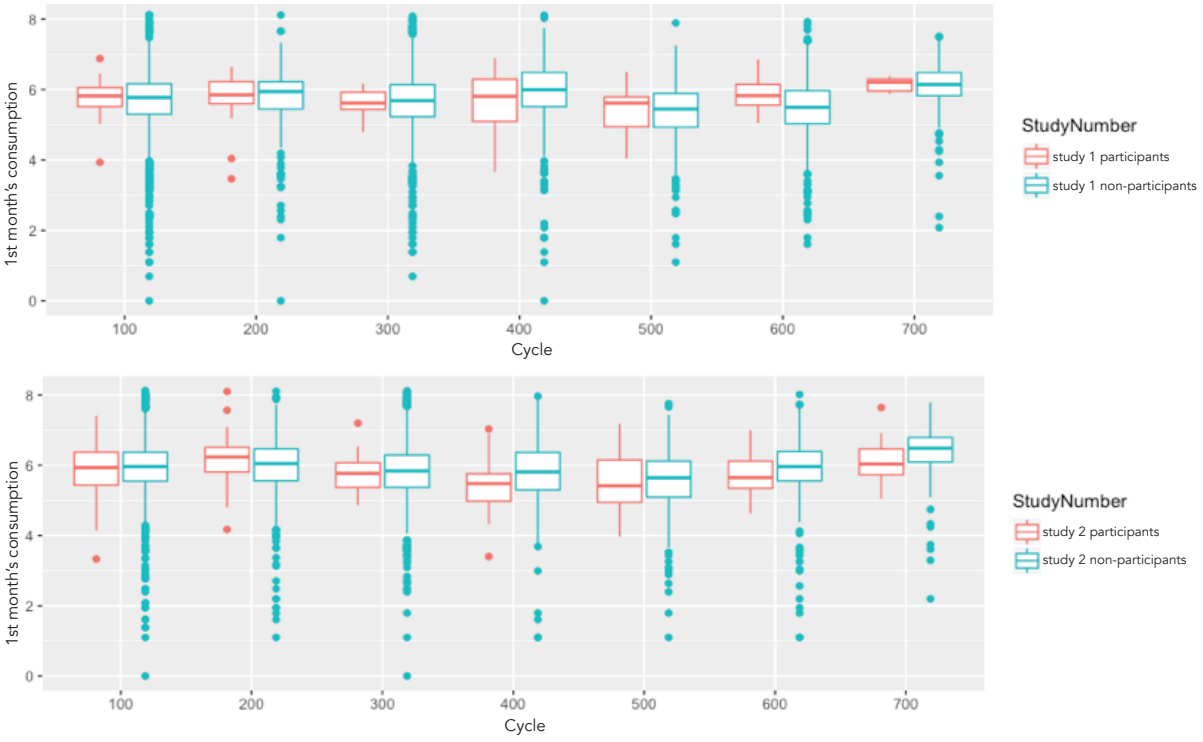


Figure 5: Log of first month's consumption by study 1 participants and non-participants

Figure 6: Log of first month's consumption by study 2 participants and non-participants

		All, post-intervention			Study 2 only, post-intervention		
		Df	F value	Pr(>F)	Df	F value	Pr(>F)
Purity/ Sanctity	(Intercept)	1	2.81	0.10	1	20.45	0.00
	Cycle	6	0.90	0.49	6	0.86	0.52
	Study Number	1	1.68	0.20			
	Intervention	2	0.50	0.61	2	1.69	0.19
	Purity.Sanctity.c	1	0.28	0.60	1	0.58	0.45
	Intervention: Purity.Sanctity.c	2	0.53	0.59	2	3.68	0.03
	Residuals	194			164		
Harm/ Care	(Intercept)	1	3.04	0.08	1	15.83	0.00
	Cycle	6	0.98	0.44	6	0.97	0.45
	Study Number	1	1.23	0.27			
	Intervention	2	0.43	0.65	2	1.07	0.35
	Harm.Care.c	1	1.04	0.31	1	0.60	0.44
	Intervention: Harm.Care.c	2	2.63	0.07	2	3.59	0.03
	Residuals	194			164		
Political Identity	(Intercept)	1	2.24	0.14	1	16.03	0.00
	Cycle	6	0.86	0.53	6	1.02	0.41
	Study Number	1	1.96	0.16			
	Intervention	2	0.45	0.64	2	1.46	0.24
	PoliticalID.c	1	0.85	0.36	1	0.65	0.42
	Intervention: PoliticalID.c	2	0.32	0.73	2	1.61	0.20
	Residuals	194			164		

Table 2: Electricity-related Behavior

The results of ANCOVAs indicate the interaction of the intervention with moral foundations was significant for electricity-related behavior.

		All, post-intervention			Study 2 only, post-intervention		
		Df	F value	Pr(>F)	Df	F value	Pr(>F)
Purity/ Sanctity Intervention	(Intercept)	1	0.30	0.58	1	0.64	0.42
	Cycle	6	0.99	0.43	6	1.17	0.33
	Study Number	1	0.01	0.93			
	Intervention	2	0.40	0.67	2	0.18	0.83
	Purity.Sanctity.c	1	0.85	0.36	1	1.73	0.19
	Intervention: Purity.Sanctity.c	2	0.19	0.31	2	1.76	0.17
	Residuals	195			165		
Harm/ Care Intervention	(Intercept)	1	0.43	0.52	1	0.76	0.38
	Cycle	6	0.94	0.47	6	1.21	0.31
	Study Number	1	0.00	0.97			
	Intervention	2	0.48	0.62	2	0.23	0.79
	Harm.Care.c	1	0.08	0.77	1	0.05	0.82
	Intervention: Harm.Care.c	2	0.85	0.43	2	0.90	0.41
	Residuals	195			165		
Political Identity Intervention	(Intercept)	1	0.61	0.43	1	0.77	0.38
	Cycle	6	1.01	0.42	6	1.29	0.26
	Study Number	1	0.01	0.94			
	Intervention	2	0.65	0.53	2	0.37	0.69
	PoliticalID.c	1	5.15	0.02	1	6.42	0.01
	Intervention: PoliticalID.c	2	0.42	0.66	2	0.61	0.54
	Residuals	195			165		

Table 3: Food-related Behavior

The results of ANCOVAs indicate the interaction of neither moral foundations nor political identity were significant to food-related behavior.

		All, post-intervention			Study 2 only, post-intervention		
		Df	F value	Pr(>F)	Df	F value	Pr(>F)
Purity/ Sanctity Intervention	(Intercept)	1	7.61	0.01	1	12.90	0.00
	Cycle	6	2.98	0.01	6	2.38	0.03
	Study Number	1	0.00	0.95			
	Intervention	2	0.60	0.55	2	0.62	0.54
	Purity.Sanctity.c	1	0.35	0.56	1	0.07	0.80
	Intervention: Purity.Sanctity.c	2	3.54	0.03	2	3.76	0.03
	Residuals	195			165		
Harm/ Care Intervention	(Intercept)	1	5.03	0.03	1	11.55	0.00
	Cycle	6	2.32	0.03	6	2.02	0.07
	Study Number	1	0.13	0.72			
	Intervention	2	0.31	0.73	2	0.37	0.70
	Harm.Care.c	1	0.28	0.60	1	0.04	0.85
	Intervention: Harm.Care.c	2	0.70	0.50	2	0.60	0.55
	Residuals	195			165		
Political Identity Intervention	(Intercept)	1	7.68	0.01	1	14.03	0.00
	Cycle	6	2.99	0.01	6	2.41	0.03
	Study Number	1	0.03	0.87			
	Intervention	2	0.35	0.70	2	0.49	0.62
	PoliticalID.c	1	0.40	0.53	1	0.21	0.65
	Intervention: PoliticalID.c	2	5.04	0.01	2	4.16	0.02
	Residuals	195			165		

Table 4: Transportation-related Behavior

The results of ANCOVAs indicate that the interaction of purity and political identity with the intervention were significant to transportation-related behavior.

Self-Reported Behavioral Differences Among Participants

To examine changes in self-reported behavior, ANCOVAs tested the effect of a person's moral foundations and their assigned intervention on the ratio of pre- and post- behavior, controlling for cycle and study number. The ratio of pre- and post-behavior mirrored the electrical consumption ratio. The log of the first week of behavior self-reporting plus one was divided by the average of weeks four and five (four or five if one of the weeks was missing) plus one. One was added to allow the use of a log transformation when some weekly behavioral reports were zero. Thus, a negative ratio indicates the behavior became more common in weeks four and five, whereas a positive number indicates the behavior became less common in weeks

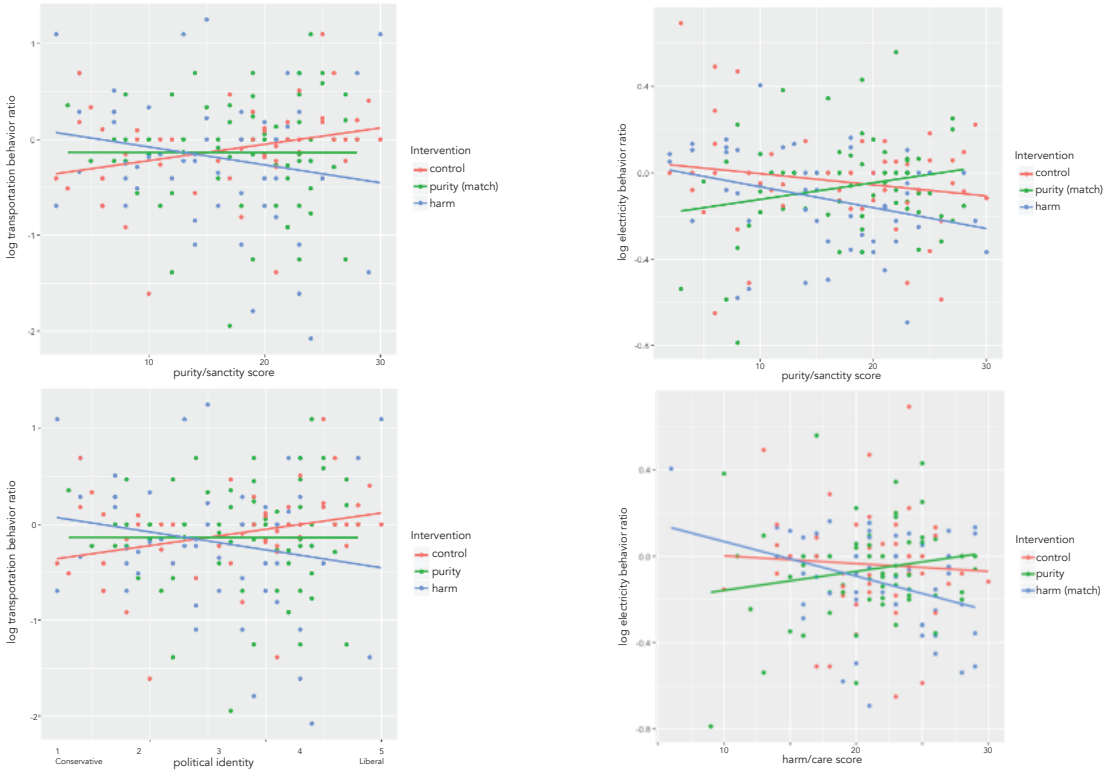


Figure 7: Ratio of electricity behavior by purity foundation

Figure 8: Ratio of electricity behavior by harm foundation

Figure 9: Ratio of transportation behavior by purity foundation

Figure 10: Ratio of transportation behavior by political identity

four and five.

Cycle, in particular, was problematic. It was necessary to the experimental design because of the time restraints in the city, which allowed pulling readings on only up to 20 of the city's 45 meter-reading routes, which are grouped in seven larger geographic billing cycles. However, the number of participants was limited once they were divided in sub-groups of the three interventions and seven billing cycles (Table 1). Additionally, a few outliers may have been influential.

ANCOVAs were run separately for each behavior category: electricity, food, and transportation. The results indicate that the intervention had a significant interaction with both harm/care and purity/sanctity moral foundations on reported electricity behaviors. Additionally, the interaction of the intervention with the purity/sanctity moral foundation and political identity was significant on reported transportation behavior, while the intervention and harm/care interaction was not significant. Neither the moral foundations nor political identity had significant interactions with the intervention on food behavior. See Tables 2-4 for results.

In a follow-up to the significant results, the slopes were compared to each other and to zero (Figures 7-10). For electricity-related behaviors, the harm intervention differed significantly from zero ($p = 0.04$) and the purity intervention ($p=0.01$) but not the control ($p=0.43$) when compared against participants' purity/sanctity moral foundations. When compared against participants' harm/care moral foundations, the harm intervention differed significantly from zero ($p = 0.02$) and the purity intervention ($p=0.01$) but not the control ($p=0.19$).

These results indicate a distinction between harm and purity interventions. Participants appear to have received the non-moral control intervention more similarly to the harm intervention. Additionally, people with both high purity and high harm moral foundations reported greater adoption of electricity behaviors when they received the harm messaging,

whereas people with low moral foundations scores reported the most electricity-related behaviors with the purity messaging.

Transportation behavior results show a different pattern than the electricity-related behavior. For transportation behaviors, the harm intervention seems to have been perceived more similarly to the purity intervention than the control. The slope of the harm intervention significantly differed from zero ($p=0.05$) and from the control ($p=0.01$) but not the purity intervention ($p= 0.21$). Once again, people with high moral foundations scores reported greatest behavior adoption with the harm messaging, even though the messaging is not necessarily congruent to the moral foundation. People with low moral foundations reported the greatest behavior adoption with the control intervention.

Political ID was also correlated to transportation behavior. The most conservative participants showed the greatest adoption with the control intervention, and the most liberal participants showed the greatest adoption with the harm intervention. While the control and harm interventions showed a significant difference ($p=0.00$) and the harm intervention was significantly differed from zero ($p=0.02$), the difference was not significant between the harm and purity interventions ($p=0.17$).

While neither intervention was consistently effective at increasing behaviors compared to the control and other intervention, paired t-tests indicated overall reported electricity-related behaviors increased slightly over the course of the second study ($p=0.00$, 95% CI: -1.01 to -0.43). Participants reported an increase in transportation behaviors as well ($p=0.01$, 95% CI: -0.66 to -0.08). The increase, however, did not extend to pre-and post-food behaviors ($p=0.41$, 95% CI: -0.37 to 0.15).

Discussion

First, this study found that harm-based interventions produced a small but significant change in electricity and transportation reported behaviors. In contrast to previous studies, the results indicated that harm interventions increased energy and transportation-related behaviors more strongly with people with high harm moral foundations scores for electricity and transportation-related behaviors (congruent) but also high purity scores for electricity-related behaviors (incongruent). These findings are inconsistent with hypothesis 1.2. Previous research has found that interventions matching participants' political identity, which is correlated to moral foundations, resulted in the largest behavioral change (Feinberg & Willer, 2013; Kidwell et al., 2013; Wolsko et al., 2016).

The difference could be partially rooted in methodology. Whereas similar studies focused on political ideology, for which the studies have one measure, the current study focused on matching moral foundations, for which participants could have equal or differing scores for purity and harm. Yet, this study also tested the interaction of the moral foundations interventions with political identity. The interaction was only significant for transportation behaviors. While the effect of the harm intervention was more effective for liberal participants, as predicted, the control was more effective than the purity intervention for conservative participants.

The effectiveness of the control is inconsistent with hypothesis 1.1 that the moral messaging would be more effective. Again, methodology could be influential. Other studies have differentiated liberals and conservatives by separating participants who were one standard deviation above or below the mean for examination, whereas this study used a continuous scale so as to include all participants in the analysis (Feinberg & Willer, 2013; Kidwell et al., 2013; Wolsko et al., 2016). However, the shifting similarities in response to the moral and control

messaging could also have been evidence that the control and moral messages did not differ enough from each other.

Furthermore, the results indicate some difference in which categories of behaviors participants changed. Transportation and electricity-related behaviors increased slightly over the course of the study, but food-related behaviors did not. The difference in electricity was hypothesized in this study (h2.1), but the change in transportation-related behavior was not. These results are supported by some previous research, which have found that the most preferred actions are technological efficiency measures, among people who can afford them (Poortinga et al., 2003). Indirect energy saving measures, such as changing one's diet, tend to be less preferred or effective (Abrahamse et al., 2007; Poortinga et al., 2003). Still, some research would indicate transportation-related behaviors are resistant to change because individuals perceive alternatives as expensive or inconvenient (Büchs et al., 2018; Chatterton et al., 2009; Whitmarsh, 2009).

Additionally, the results indicate a disparity between reported behavior and objective results, which is consistent with the literature and consistent with hypothesis 2.2 in this study (Armitage & Conner, 2001; Corral-Verdugo, 1997; Csutora, 2012; Tabi, 2013). Though the moral foundations-based interventions were not effective at decreasing electrical consumption, participants reported a slight but statistically significant increase in electricity-related environmental behaviors. The correlation coefficient between electrical consumption and electrical behavior ratio was very low, -0.03.

Though this study did not identify a cause for the disparity, a few are possible. Participants may have adopted behaviors not measured by electrical utility data. The study did not have access to natural gas use or solar production. Few people in the study had solar energy, so it is unlikely that it was a significant factor. Yet, natural gas is commonly used for central

heating, stoves, and water heaters. Participants could have reduced energy use in ways undetectable to the study.

Alternatively, the small effective level of behavior adoption could have meant the effect was too weak to appear in the electrical consumption data. For example, the study asked people to report on turning off lights and electronics, but some households could have electric stoves, dryers, and other appliances that constitute a larger portion of their electrical usage. Given the seasons for these studies, it is unlikely that air conditioners or fans would have been in use. Nevertheless, even if individual participants adopted the measured behaviors, electricity was measured for the whole household. Thus, if only that individual adopted the behaviors, small changes could have been insignificant compared with other energy uses that dominate household consumption.

Another explanation is that participants modified behavior in the reported areas, which elicited moral licensing. Participants may have adopted behaviors tracked in the study that would reduce electricity consumption while increasing electrical consumption through behaviors that were not tracked in the study (Merritt et al., 2010). Participants also may have inaccurately reported behavior because they did not remember, or they may have biased their responses to be more socially desirable (Kormos & Gifford, 2014).

Furthermore, the study evaluated behavior four and five weeks from the intervention. Week two asked about behavioral intentions rather than behavior over the past week. Four to five weeks from the intervention could have been too long since the effects of interventions can fade over time (Nisa et al., 2019; Yan & Liu, 2016; Zillmann et al., 1999). However, if the fading effect occurs within four to five weeks, the intervention would not have caused long-term change.

Other studies have shown similar results. The results of a study that ran from 2014 to

2016 in the UK showed that while calculators raised awareness of environmental actions and concern about climate change, the calculator did not change energy or travel-related energy use (Büchs et al., 2018). Thus, calculators may require more substantial assistance, such as orchestrated competitions, to effectively change behavior and associated carbon emissions (Jones & Kammen, 2014; Lambert, 2013). High engagement interventions are more effective for behaviors that require greater effort (Osbaldiston & Schott, 2012).

This study has a few weaknesses. A common issue in energy conservation research, this study included, is large within-group variance (Abrahamse et al., 2007). A larger sample would provide greater statistical power for analysis. The response rate was just under 10% in the second study and less than 3% in the first study. Providing the calculator and study materials in multiple languages and collecting the survey and carbon calculator in paper format would possibly have provided a larger and more representative sample. Although the sample was similar to the city in income, requiring an Internet survey could exclude people who are less technologically savvy or unable to afford or access the Internet.

Additionally, the sample was disproportionately white, and survey options in other languages could have expanded the people who would participate to represent the city better. The trend in responses to be a higher percentage Caucasian and more highly educated than the city as a whole reflects a general bias in research toward white, educated, industrialized, rich, democratic (WEIRD) cultures, and future studies should address diversifying the sample (Henrich et al., 2010).

Inclusion of objective measures of food and transportation behaviors would also have strengthened the results and improved the comparison between reported behavior and objective behaviors. Finally, this study's control group took a carbon calculator with a non-moral message. A second control group that reported behavior but did not take a calculator would have provided

more information on the effectiveness of the calculator as a standalone tool to affect reported and objective behavior change.

Conclusions

The results of this study indicate that interventions aligning with the harm foundation can provide a small but measurable increase in behaviors related to electricity and transportation in conjunction with a carbon calculator for people with high moral foundations scores. The purity intervention was most effective for people with low moral foundations scores for electricity-related behaviors. However, the control was most effective for people with a low purity foundation for transportation-related behaviors. While the most and least effective interventions are significantly different from each other, the differences are slight. Furthermore, the third intervention fell between the two, and that intervention was not significantly different than harm, which was the intervention with the most consistent results regarding behavior.

However, people with low moral foundations in the harm condition slightly decreased environmental behaviors, making it potentially unsuitable for messaging that targets the general public. It could alienate people with low moral foundations scores and potentially people who identify as libertarian (Iyer et al., 2012). Additionally, the changes in electricity behaviors were not correlated with decreases in actual electrical consumption and associated carbon emissions.

Future studies should look at relationships between reported behavior and measurable behavior with regards to other areas of significant carbon emissions, such as food consumption and transportation. This study supports a growing body of work that suggests that studies measuring reported environmental behavior might overestimate the measurable results of those behaviors. Combinations of interventions in addition to messaging could be more effective at reducing carbon emissions at the individual level. (Nisa et al., 2019; Osbaldiston & Schott, 2012).

CHAPTER 3

PREDICTORS OF PRO-ENVIRONMENTAL BEHAVIOR ADOPTION AND NON-ADOPTION

Highlights

- The predictors of pro-environmental behaviors differed between and within transportation, energy, food, and activism behavior categories.
- Self-efficacy was the most consistent predictor of pro-environmental behaviors.
- Multinomial regressions predicted the highest percentage of variance for adoption or non-adoption of activism behaviors cross compared between models for transportation, energy, and food-related behaviors.
- A linear regression including self-efficacy, gender, age, purity moral foundation, guilt-repair, and shame-withdrawal predicted 25% of the variance in the number of pro-environmental behaviors participants adopted.

Abstract

Today's actions, and their effects in either fueling or mitigating climate change, will have a profound impact on the future. Changing course is a necessity, and people need to alter behaviors individually and collectively, in private, public, and political spheres. In this study, participants answered questions about their adoption of 18 pro-environmental behaviors. Additionally, participants responded to questions about demographics, attitudes, self-efficacy, moral foundations, and guilt and shame proneness. Predictors of each behavior were analyzed

through multinomial regressions. The number of behaviors participants had adopted were also examined through linear regression and a random forest to compare the results of different approaches. Major predictors differed between behaviors. However, self-efficacy, political identity, and age were significant in the highest number of multinomial models. The linear regression model explained 25% of variance in the number of behaviors adopted: self-efficacy, guilt-repair, shame-withdrawal, purity moral foundation, age, and gender.

Keywords

Predictors of Pro-environmental Behavior, Guilt and Shame Proneness Scale (GASP), Moral Foundations, Self-Efficacy

Introduction and Background

Humans affect the environment in numerous ways—lighting up the night skies, domesticating plants, mining minerals, releasing gases into the atmosphere, and more. Mitigating the damage caused by human actions has spurred interest in altering behavior, often by encouraging people to become more "sustainable" through individual actions, such as reducing resource consumption through a vegetarian diet or taking shorter showers (Maniates, 2001). Non-profits like the Footprint Network and The Nature Conservancy facilitate people calculating their personal impact in water usage and carbon dioxide production. These programs appeal to participants' feeling of moral responsibility to align personal practices with the calculators' estimation of the Earth's capacity to support them (Spaargaren, 2011). The emphasis on individual choices promotes choosing high efficiency appliances, riding a bicycle or bus, and other such actions with the hope that if enough people make these choices, it will reduce humanity's collective footprint.

People do not have to look far for these messages. The United Nations Environmental Programme (UNEP) recently published *The Little Book of Green Nudges*, explaining "This book contains a wealth of ideas and tips, but it's only a starting point. UNEP needs you to take this initiative to the next level" (United Nations Environment Programme, GRID-Arendal and Behavioural Insights Team, 2020). Articles like "Reducing Your Carbon Footprint" in the New York Times or "What we eat has bigger consequences for the planet than we ever thought" in the Washington Post are summarized well by Janet Ranganathan, World Resources Institute's vice president for research, data, and innovation: "We're trying to advocate for small shifts that can have a significant impact on people's environmental footprint," (Harvey, 2016; Stellin, 2013).

A go-to manual for implementing community-level environmental behavior change, *Fostering Sustainable Behavior*, starts with educators identifying the issue, then picking a target behavior (McKenzie-Mohr, 2013). Ideally, the behavior should be as specific as possible in order to facilitate the identification of barriers and benefits to engaging in the behavior and development of a strategy (McKenzie-Mohr, 2013). Community-based social marketing targets the implementation of effective behavior change since education alone does not necessarily lead to environmental behavior, nor does environmental behavior necessarily lead to measurable impact (Csutora, 2012; Kollmuss & Agyeman, 2002; Tabi, 2013). Since many of the behaviors people adopt may be tokenistic and not representative of the most impactful changes individuals can make, it is especially important to focus efforts (Gifford, 2011).

Actual impactful behavior change is challenging due to inertia, faith in technology, and belief that change requires sacrifice, among other reasons. Not the least of the challenges is in the face of an existential crisis, communicators must weigh the risk of causing fear, which could backfire by triggering denial instead of action (Oskamp, 2000). Social scientists have identified factors affecting the adoption of behaviors, and behavior change campaigns attempt to influence

aspects of the decision-making process. Such variables include values, beliefs, norms, knowledge, attitudes, perceived barriers, perception of risk, and self-efficacy (Ajzen, 1991; Bandura, 1977; Fishbein & Ajzen, 2011; Gifford & Nilsson, 2014; Stern, 2000).

Theories of behavior change encapsulate these factors to explain human behavior. One of the most prominent is the Theory of Planned Behavior, which describes the influence of attitudes, subjective norms, and perceived behavioral control on intention to perform a behavior (Ajzen, 1991). Theory of Planned Behavior is an expansion of the theory of reasoned action, which attributes intention to subjective norms and attitudes (Fishbein & Ajzen, 2011). When individuals can control their behavior, theory of reasoned action has a moderate predictive ability. However, the theory's predictive ability declines when people have less control over their actions. Thus, perceived behavioral control or self-efficacy was added to Theory of Planned Behavior from the work of Bandura to account for control, which improves its predictive power (Bandura, 1977; Madden et al., 1992).

Yet, even with the variables represented in the Theory of Planned Behavior, the model explained an average of 39% of the variance in environmental behavioral intentions. (Armitage & Conner, 2001). It explains less of the variance of self-reported behavior, 27% in two meta-analyses (Armitage & Conner, 2001; Bamberg & Möser, 2007). Furthermore, it explains still less of the variance of actual behavior, which may be indicative that participants' perception of performing the behavior, i.e. reported behavior, does not align with the measured outcome, or that despite good intentions, participants do not participate in actual behavior change (Armitage & Conner, 2001).

Pro-environmental behaviors (PEBs) are heterogenous (Blankenberg & Alhusen, 2018). Past research has observed that different types of behaviors are weakly related, depending on an array of factors (Harland et al., 1999; Ortega-Egea et al., 2014). Predictors differ between types of

environmental behaviors and even within types (Stern et al., 1983; Truelove & Gillis, 2018). Stern (2000) goes as far as to propose that a general theory of environmentalism might be ineffective at influencing particular behaviors.

The differences between behaviors reflect external and internal factors and the opportunities available (Steg & Vlek, 2009). Individuals may recycle but not carpool. Likewise, the models to predict the behaviors might differ. It is also possible predictors between waste reduction behaviors in general might differ from transportation behaviors, depending on the location of the household, city services available, or age of people in the household. For example, a study examining energy curtailment found that age, gender, and perceived behavioral control were influential for the majority of behaviors, but some behaviors had a mix of the associated predictors (Botetzagias et al., 2014). Other studies on energy have found similar patterns (Frederiks et al., 2015). Yet, it is also possible that additional data could reveal whether differences truly exist between behaviors or whether the differences are evidence of limited sample sizes or other issues. Thus, several researchers have called for greater study of the predictors for specific PEBs (Blankenberg & Alhusen, 2018; Kormos & Gifford, 2014).

Based on existing evidence for differences between environmental behaviors, one cause of the limited explanation of variance in the Theory of Planned Behavior may be that predictors differ between behaviors or types of behaviors. Thus, a model designed to predict a particular behavior or behavior type may explain more of the variance for that behavior (Gatersleben et al., 2002; Steg & Vlek, 2009). Thus, classifying behaviors into groups is one way to address variations between behavior types. Groups could categorize by different criteria too, such as by cost, impact, or type of behavior. Although classification loses specificity of predicting individual behaviors, it provides middle ground between predicting all pro-environmental behaviors together and each PEB, one at a time. Given the ongoing discussion about predictors, the present

study identifies patterns among behaviors, particularly moral aspects of behavioral choices. It looks at four groups of behaviors: transportation, energy, food, and activism. (See appendix F for a full list.)

One principal difference between this study and others is that it measures the adoption level of each pro-environmental behavior as one of four categories: “currently do,” “could do but don’t,” “could do and planning to,” and “could not do.” Many other studies measure frequency of behavior performance (Blankenberg & Alhusen, 2018). While measuring one category for performance and three categories for non-performance introduces some ambiguity about frequency of a behavior, it also separates participants who choose not to perform a behavior and who cannot perform a behavior. For example, a renter may have no access to their water heater or influence in the decision of its efficiency. In some studies, this person is listed as simply not performing the behavior or not applicable. In this study, a person who cannot control their behavior would be in a separate category from someone who chooses not to or who is planning to perform the behavior. This study investigates “why not” as much as “why.”

This study also adds to the body of research on this topic by exploring predictors of behavior, looking at harm and purity moral foundations as well as the guilt and shame proneness (GASP) scale. Although previous studies have included moral norms in models of behavior, to our knowledge, these specific subscales have not been used in this context (Botetzagias et al., 2015; Klöckner, 2013; Yuriev et al., 2020). Understanding predictors of specific behaviors is useful for policymakers and individuals working on behavior change initiatives to enhance benefits and address barriers most effectively.

Questions

Q1. Which factors influence a participant's pro-environmental behavioral choices,

especially differences between people who "currently do" and people who "could do but don't" engage in a behavior?

H1.1 Participants with higher self-efficacy, environmental attitudes, harm moral foundations, purity moral foundations, guilt-repair, negative behavior evaluation, negative self-evaluation, income, and level of education will have higher odds of currently doing a behavior than choosing "could do but don't," as will participants with liberal political identity and female gender. However, effect sizes will be smaller for income, gender, and education (T. R. Cohen et al., 2011; Koleva et al., 2012; McCright et al., 2016).

H1.2 Conversely, participants with lower moral foundations, income, and education level will have higher odds of choosing "could do but don't" than "currently do," as will participants with conservative political identity, higher shame withdrawal, and male gender.

H1.3 Participants who could not do a behavior may differ in income and age from participants who currently do a behavior, due to financial limitation, physical limitation, or family responsibilities (McCright et al., 2016).

H1.4 Participants who are planning to perform a behavior may differ in self-efficacy from participants who currently perform a behavior.

Q2. Which factors influence the quantity and type of pro-environmental behaviors adopted among people who "currently do" these pro-environmental behaviors?

H2.1 More people will currently engage in energy behaviors than other categories of behaviors (Poortinga et al., 2003).

H2.2 Self-efficacy will be significant among transportation behaviors (Heath & Gifford, 2002).

H2.3 Moral foundations and GASP variables will be significant among people who currently engage in food-related behaviors (T. R. Cohen et al., 2011; Mäkiniemi et al., 2013).

H2.4 Political identity will be significant to activism behaviors (Schmitt et al., 2019).

H2.5 Participants with higher self-efficacy, environmental attitudes, harm moral foundations, purity moral foundations, guilt-repair, negative behavior evaluation, negative self-evaluation, income, and education level will have adopted more behaviors across behavior types, as well as participants with female gender and liberal political identity (T. R. Cohen et al., 2011; Koleva et al., 2012; McCright et al., 2016).

Predictors of Pro-Environmental Behavior

Environmental Attitudes

Attitudes embody an individual's assessment of an "object of thought," which could include ideas, people, things, or anything a person could have in their mind (Bohner & Dickel, 2011). This study focuses on PEBs, and individuals can hold more than one attitude about the same PEB or environmental issue at the same time (Ajzen, 2001). Composting can be inconvenient, stinky, virtuous, and a connection to nature simultaneously. Recognizably, environmental attitudes are an important factor in predicting behavior. Two commonly used theories of behavior include attitudinal variables. Attitudes are one of only three predictors in the

Theory of Planned Behavior that lead to intention and behavior (Ajzen, 1991). Likewise, Value-Belief-Norm Theory accounts for beliefs among its predictors (Stern et al., 1999).

Thus, attitudes appear significant in many models examining environmental decision-making and climate change views. A meta-study found that they were the only variable statistically significant in the predicted direction in every study in which it appeared, regardless of how researchers measured it (McCright et al., 2016). This study measures environmental attitudes with a five-question Brief Ecological Paradigm (BEP), which is a short version of the New Ecological Paradigm (Dunlap et al., 2000; López-Bonilla & López-Bonilla, 2016).

Perceived Behavioral Control/Self-efficacy

Behavioral control is a belief in one's ability to execute a behavior (self-efficacy) (Ajzen, 2020) It affects whether a person even attempts the behavior. For example, if a person has multiple options to get across town and believes that the bus schedule is inconvenient, then the bus is an unlikely choice. Regardless of the actual bus schedule, the perception of personal ability to perform the behavior is a significant predictor. However, perceived behavioral control may be inadequate to measure when a person completely lacks control over a behavior, such as if the person lived in an area without a bus (Ajzen, 2011).

Numerous studies include perceived behavioral control or self-efficacy, which Ajzen (2020) claims are conceptually identical. However, instruments measuring perceived behavioral control focus on whether an individual can control a behavior, and instruments measuring self-efficacy focus on whether an individual has the ability to overcome obstacles (Ajzen, 2020). Research supports that self-efficacy explains more of the variance in intentions and equivalent variance in behavior as perceived behavioral control (Armitage & Conner, 2001).

Self-efficacy has been significant in numerous studies of environmental intention and

behavior (Hanss & Böhm, 2010; Schutte & Bhullar, 2017; Thøgersen & Grønhøj, 2010). Measures of self-efficacy are better predictors of behavior if they are specific to the domain of the behavior, so this study measures self-efficacy with three questions that ask participants about their influence on climate change (Bandura, 1977; Hanss & Böhm, 2010).

Moral Foundations

Personal norms are expectations individuals have for themselves or feelings of moral responsibilities (Schwartz, 1977). Theory of Planned Behavior and Value-Belief-Norm both include moral norms. In Value-Belief-Norm Theory, values incorporate altruistic, egoistic, and biospheric traits (Stern, 2000). In Theory of Planned Behavior, moral norms appear to be a precursor to attitudes or intentions (Jansson & Dorrepaal, 2015; Kaiser et al., 2005; Kaiser & Scheuthle, 2003).

In studies of PEBs, personal or moral norms have shown mixed results. In some, moral considerations were important in addition to the variables in Theory of Planned Behavior (Kaiser, 2006; Rivis et al., 2009). A study of recycling intentions found moral norms, in fact, to have a larger effect than attitude (Botetzagias et al., 2015). However, moral concerns did not show the same influence on electricity curtailment (Botetzagias et al., 2014).

In this study, we draw on Moral Foundations Theory (MFT) to measure participants' relationships to moral norms. Moral Foundations Theory concerns the origins and variations in moral beliefs across ingroup/loyalty, authority/respect, purity/sanctity, harm/care, and fairness/reciprocity (Graham et al., 2009). Although MFT is not a theory that predicts behavior change, numerous researchers have recognized its potential in communicating how pro-environmental behavior fits into people's views of the world.

Relationships between moral foundations and environmental attitudes are present in

research spanning the globe, though more extensively tested in western, educated, industrialized, rich, and democratic countries (Dawson & Tyson, 2012; Jansson & Dorrepaal, 2015; Koleva et al., 2012). Conservatives tend to hold all five foundations more evenly, while liberals tend to favor harm and fairness (Graham et al., 2009). This difference may influence environmental attitudes and behavior because political conservatives tend to perceive PEBs as less of a moral issue than liberals (Currie & Choma, 2018; Feinberg & Willer, 2013).

Yet, Moral Foundations Theory still predicts attitudes of Americans on global warming in addition to many other issues, even when controlling for the effects of ideology and other factors (Koleva et al., 2012). Both purity, which relates to an aversion to contamination and the restraint of base instincts, and harm foundations, which relates to nurturing and protecting those who are vulnerable, are effective predictors of attitudes on climate change regulations (Graham et al., 2009; Koleva et al., 2012). A parallel study of Australian adults found that moral intuitions predicted attitudes toward climate change response, including that harm and fairness predicted preferences for a stronger response to climate change (Dawson & Tyson, 2012).

While studies do not agree on all of the relationships of specific foundations to environmental attitudes, this study includes harm and purity foundations, which seem to be most commonly related to environmental attitudes (Feinberg & Willer, 2013; Kidwell et al., 2013; Koleva et al., 2012; Wolsko et al., 2016). For example, evidence seems to support that harm and fairness foundations are related to environmental attitudes, personal norms, and preference for action on climate issues (Dawson & Tyson, 2012; Dickinson et al., 2016; Jansson & Dorrepaal, 2015). Purity may be a predictor of preferences for more stringent global warming restrictions, but studies diverge on this relationship (Dawson & Tyson, 2012; Koleva et al., 2012).

Guilt and Shame Proneness (GASP)

Moral emotions such as guilt and shame also affect environmental behavior. Guilt or anticipated shame can be persuasive in encouraging behavioral intention and support for an environmental group (Amatulli et al., 2019; Baek & Yoon, 2017; Mallett et al., 2013). Anticipated feelings of moral regret could increase the explained variance in intention to perform behavior by 18% above Theory of Planned Behavior (Kaiser, 2006). Thus, to measure the influence of guilt and shame on PEBs, the participants completed all four sections of the Guilt and Shame Proneness scale (GASP). Two of the subscales center on guilt and measure participants' negative evaluation of behavior and tendency to repair actions that caused guilt in private. These guilt subscales highly correlated with each other and negatively associated with unethical decision making (T. R. Cohen et al., 2011). The other two subscales measure shame as negative self-evaluation and as a tendency to withdraw from a public shame-inducing situation. The shame subscales weakly correlated with each other. Shame as a negative self-evaluation inhibited unethical decision making, but shame as withdrawal did not share this effect (T. R. Cohen et al., 2011).

Demographic variables

Several sociodemographic variables may also be influential. Liberal political ideology and female gender often correlate to stronger climate beliefs (Blankenberg & Alhusen, 2018; McCright et al., 2016). Age and education are often not significant in models, but in some studies, younger age and higher education are associated with stronger climate beliefs (McCright et al., 2016). A meta-study found that age may be non-linear, aligning with stages of life (McCright et al., 2016). Between the ages of 30 and 60 can serve as a low point in environmental behavior, when people are working, possibly in addition to raising a family (Blankenberg & Alhusen, 2018). Level of education may be correlated with specific behaviors. For example, a high level of

education may be positively correlated with PEBs like boycotting overly packaged products or keeping the thermostat low, whereas a low level of education may positively correlate with others, like turning off the lights or taking public transit (Blankenberg & Alhusen, 2018).

Income is often not significant in models (McCright et al., 2016). However, it may depend on the behavior. A higher income can be associated with more emissions and greater likelihood to participate in renewable energy programs (Blankenberg & Alhusen, 2018). Attitudes and norms are less influential than homeownership, for example, for high effort or expensive actions (Stern et al., 1983). Thus, income was included with other demographic variables to allow the study to control for variables that could influence PEB. Demographic variables also allow for comparison between the study sample and the population.

Methodology

Participants completed a brief survey approved by the university's institutional review board, which was available to Amazon Mechanical Turk (mTurk) workers residing in the United States. Participants completed the approximately 10-minute survey between February 5 and 8, 2020 for the compensation of $1.25.

Upon completing a standard consent form, participants classified 18 PEBs into four categories indicating their household's level of adoption of the behavior: "currently do," "could do but don't," "could do and planning to," and "could not do." The behaviors covered four categories: transportation, energy, food, and activism (Truelove & Gillis, 2018). The participants answered follow-up questions on the attribution of responsibility, which are not included in this article. Finally, they completed questions on social and psychological measures, as well as demographics. These include environmental attitudes, self-efficacy, purity and harm moral foundations, guilt and shame proneness, gender, age, race, education, income, political identity,

and geographic location. These measures are included as possible predictors for PEB and for comparison to participants to the US to evaluate how representative this sample is of the country. Appendix F contains full survey questions.

The study team planned to recruit participants for 385 usable responses. Another similar survey reported 19% of participants failed attention check questions (Hoover et al., 2018). Thus, this survey was distributed to 531 participants, 26% of which failed the attention check, leaving 394 complete surveys in the analysis. Seven participants identified as libertarian, a political identity that is not ordinal with the conservative to liberal spectrum and associated with alternative moral foundations (Iyer et al., 2012). These participants could not be included in analysis reflecting moral foundations or political identity. This left 387 usable responses for the regression models.

We tabulated response distributions for all behavior questions. Those behaviors without at least 30 observations in all categories were not further analyzed because the sample sizes were too small. We used Pearson correlation coefficients to evaluate associations between predictor variables, using the corrplot package in R to produce a Pearson correlation matrix for the numeric predictor variables (Wei et al., 2017).

To identify which demographic and sociological factors influence adoption for each behavior (Question 1), we ran multinomial logistic regressions of adoption-level response ("currently do," "could do but don't," "could do and planning to," and "could not do" on a nominal scale). The multinomial regression estimates the odds of the response level (relative to the reference) as a linear combination of the predictor variables. The "currently do" adoption level was the reference category because the study investigated the alternatives to performing a behavior. The alternatives were three reasons not to perform a behavior. We ran 15 multinomial regressions, one on each behavior that had at least 30 observation in each category.

To identify the model with the lowest Akaike's information criterion (AIC), each regression was run with the "stepAIC" function in the MASS package in R with all the predictor variables: five demographic, Brief Ecological Paradigm, self-efficacy, purity and harm moral foundations, and each of the four GASP variables (Venables & Ripley, 2002). If both self-efficacy and Brief Ecological Paradigm were significant, which were highly correlated, then the model was run with each separately and the model with lower AIC was selected.

Finally, to investigate the demographic and sociological factors influencing how many behaviors an individual would adopt (Question 2), we ran a linear regression and a random forest to identify the model with the most explanatory value. For the conditional forest analyses, we used the cforest function in the party package in R (Hothorn, Bühlmann, et al., 2006; Hothorn, Hornik, et al., 2006; Strobl et al., 2007, 2008). In all of the models, ordinal predictor variables were classified as numeric (Pasta, 2009). Each of the models started with all the predictor variables. Model selection was conducted using the stepAIC function in the MASS package in R to identify the model with the lowest AIC (Venables & Ripley, 2002). The regression model was also checked for normality, linearity, heteroskedasticity, and influential observations.

Results

Demographic Analysis

To compare demographics of the participants, who were recruited from the US, to those of the country, we compared responses to demographic questions to national census and survey data. Gender and income were similar to the country. Gender representation was approximately equal, and income centered around the median for the country, $60,293 (*U.S. Census Bureau QuickFacts*, 2019).

However, the participants were younger, whiter, more educated, and more liberal than the population of the US. The median age was 36, younger than the median in the country, which is 38.5 years of age (U.S. Census Bureau, 2019). The difference appeared to be driven by fewer people over the age of 60 participating. Younger, more educated samples are common with mTurk, and they tend to be similar to other national samples in political ideology (Clifford et al., 2015; Ipeirotis, 2012).

People who identify as white comprise approximately 60% of the United States. However, they were 74% of our sample. Fewer people who identified as Hispanic or Latino and black or African American participated, 4% versus 18% and 8% versus 12%, respectively. The "other" category, which was comprised of participants who selected other or more than one race was over-represented, 8% versus 3% (U.S. Census Bureau, 2019).

Participants disproportionately had an education level of at least a bachelor's degree, 45%, which is greater than 20% in the US for people over the age of 25. Likewise, fewer participants had a high school education or less, 11%, compared to 38% of people in the country (U.S. Census Bureau, 2019).

Finally, participants were more liberal than the population. Half identified as liberal, while only 26% of people in America identify as liberal. The other half was split between moderates (23%) and conservatives (25%). In a representative sample, they would be approximately 35% each (Gallup Inc., 2019).

Variables

Assessments of correlation among predictor variables (Figure 11) demonstrated a strong positive correlation between Brief Ecological Paradigm, our measure of environmental attitudes, and self-efficacy, which is not surprising given that the measure of self-efficacy in this study

directly addresses climate change. Liberal political identity and the harm moral foundation had a moderate and positive relationship with both Brief Ecological Paradigm and self-efficacy. Liberal political identity had a moderate and negative correlation with the purity moral foundation. The GASP variables guilt, negative behavior-evaluation, and negative self-evaluation were moderately positively correlated with each other.

Question 1

Multinomial Regression

Each regression model is a story explaining variance for a particular behavior. Each coefficient represents a change in odds for the response based on one unit of change in the predictor. A value over one indicates the participant was more likely to choose that adoption level than the baseline, which was "currently do." Conversely, a value below one indicates that the participant was more likely to choose the baseline, "currently do." For example, a one-unit increase in the variable self-efficacy corresponds with .58 odds for responding "could do but don't" as opposed to the baseline "currently do" for the behavior walking or cycling short trips. All the variables, except the harm moral foundation and negative self-evaluation, were significant to at least one of the behaviors, and the significant variables often differed even between logits of adoption levels for the same behavior.

This study included an option to respond to exploratory open-ended questions with an explanation of a participant's decision, but it did not systematically investigate the reasons individuals chose a specific level of adoption. Therefore, interpretation of these relationships is limited to applying findings from the literature, which would need to be explored in further research.

For some behaviors, one response dominated. For example, approximately 86% of participants reported they already combine errands, 82% use energy efficient lighting, and 76% maintain correct tire pressure. Other categories of adoption were rare for certain behaviors. For example, fewer participants responded they were "planning to" adopt many behaviors. Since the behaviors in the study were intended to be familiar, participants could have already adopted them if they were interested or found that "could do but don't" or "could not do" described their situation more accurately. Response distributions for behavior questions are illustrated in Figure 12.

Although each behavior's model is unique, a few of the predictors had consistent results. While they were not significant in every behavior model, when they were, it was in the same

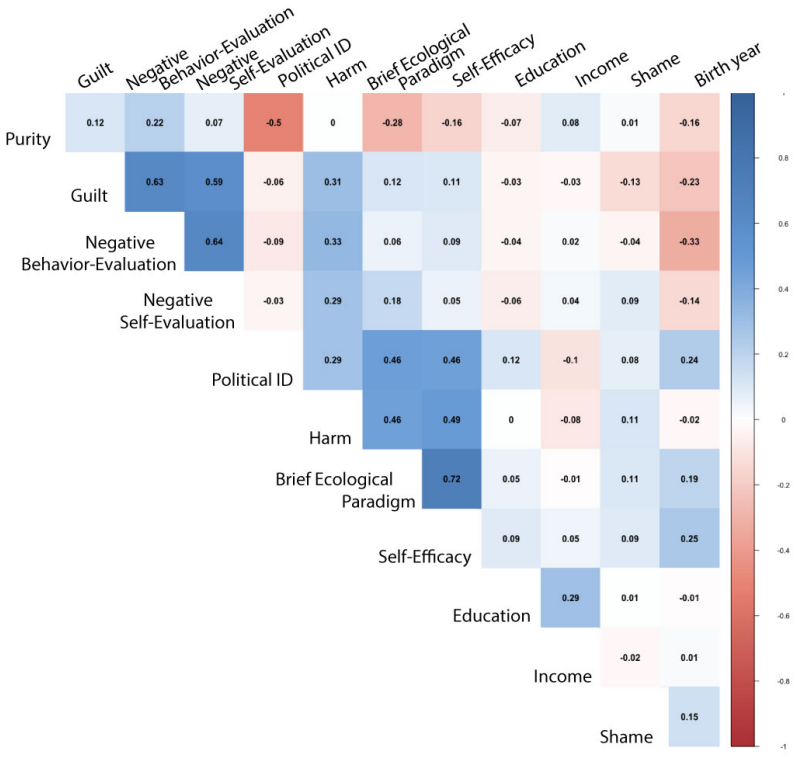


Figure 11: Correlation Coefficients Between Predictors
Coefficients of predictor variables are indicated in each square. Red indicates a negative relationship, whereas blue indicates a positive relationship.

direction. Self-efficacy was the most commonly significant variable in the regressions, appearing in the majority models as a predictor for at least one of the three adoption levels. Self-efficacy was not significant in only three models: driving a fuel-efficient vehicle, line drying laundry, and choosing a vegetarian meal over beef. The highly correlated Brief Ecological Paradigm was significant in each of those models. As self-efficacy or Brief Ecological Paradigm increased, it was less likely participants would select "could do but don't" and "could not do" compared with "currently do." This relationship indicates that as self-efficacy increased, participants were more likely to have already adopted the behavior. The full results are in Table 5.

Another pattern for self-efficacy was that it was not significant at the .05 level in most

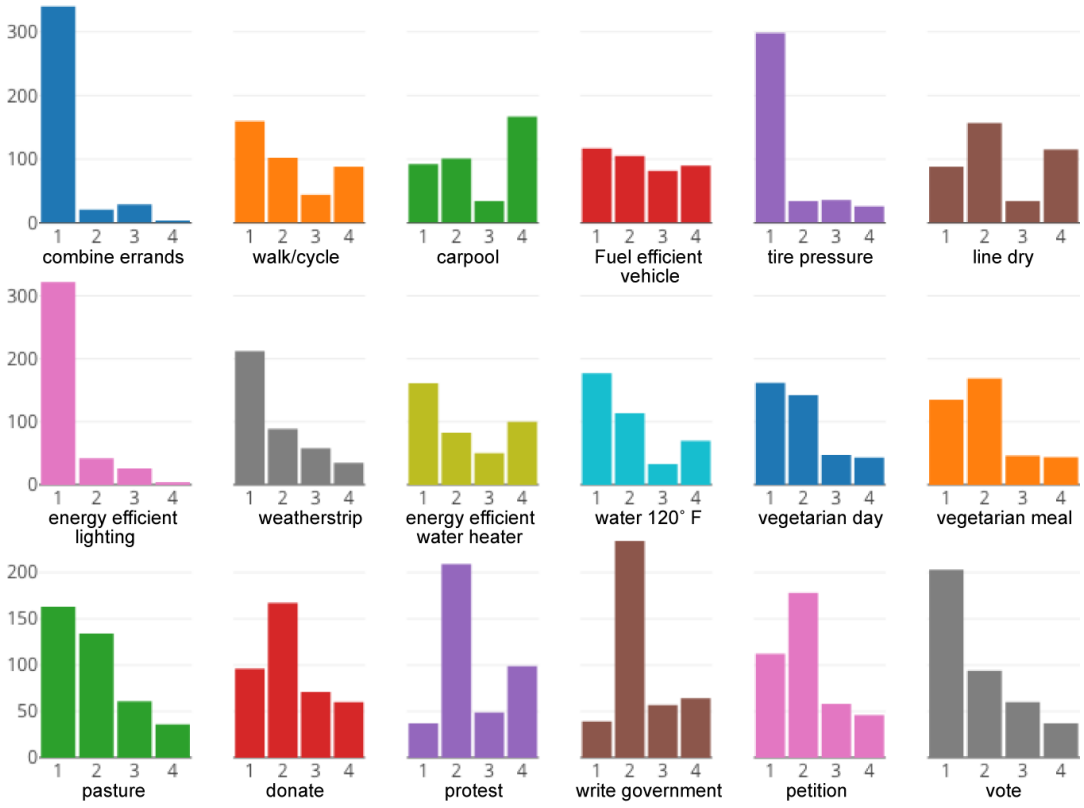


Figure 12: Frequencies of Adoption Levels of Behaviors
The distributions of responses to the 18 PEB response variables varied by behavior. The four responses are "currently do" (1), "could do but don't" (2), "could do and planning to" (3), and "could not do" (4).

models for the "planning to" response. In fact, for most predictor variables, the "planning to" adoption level was not significantly different than "currently do." A few models had no indications the groups were different at all—carpooling, line drying, using an energy efficient water heater, and eating vegetarian for one day a week. Variables that appeared most often as significant in the planning category were self-efficacy, age and variables related to morality—guilt-repair, shame-withdrawal, and purity. However, none of the variables were significant in more than a one-third of the models.

Other variables also had consistent effects. When guilt was significant at the .05 level in the models, it corresponded with being more likely to "currently do" the behavior. When shame was significant, it corresponded to greater likelihood of being in the categories "could do and planning to" or "could do but don't." These relationships indicate that participants with higher guilt-repair were more likely to "currently do" a PEB. Whereas, participants with high shame-withdrawal were more likely to report they are "planning to" or "could do but don't" do the behavior. In the literature, shame-withdrawal is positively correlated with "unethical and antisocial behavior," such as anger, hostility, and false promises (T. R. Cohen et al., 2011). Conversely, guilt-repair is negatively correlated with the same measures. It is possible that this polarized relationship is also appearing in the PEB models.

Income was consistent as well. As it increased, participants became less likely to respond that they "could not" perform behaviors with costs associated, such as purchasing or using a fuel-efficient vehicle, purchasing or using an energy efficient water heater, choosing pasture-raised food, and donating to an environmental organization. Interestingly, setting a water heater's temperature to 120° F, which could be a cost-saving measure, was also included in the trend. It could be representative of people with higher incomes being more likely to live in homes where they have access to their water heaters. Some multi-family housing settings, for example,

have shared or remote hot water systems.

The other variables were more context-dependent. Age, for example, can cause physical limitation, but it can also give a person more time to acquire experiences, and age represents different stages of life (McCright et al., 2016). As participants increased in age, they were more likely to respond they "could not" walk or cycle, protest, or carpool. Older participants were also more likely to respond "could do but don't" to walking or cycling and carpooling. However, older participants were more likely to choose "currently do" than "could do but don't" for several other behaviors. They were more likely to choose to drive a fuel-efficient vehicle, write government, weatherstrip, use an energy-efficient water heater, set a water heater to 120° F, eat vegetarian one day a week, and choose a vegetarian meal over beef. Overall, age was the second most commonly significant variable in the models.

Political identity had mixed effects as well. More liberal participants were less likely to choose "could not do" or "could do but don't" for the activism PEBs: petition, protest, vote, and write government about an environmental issue. Conversely, liberal participants were more likely to respond "could not do" or "could do but don't" for the using an energy-efficient water heater and setting a water heater to 120° F behaviors.

Although negative self-evaluation was not significant in any of the models, negative behavior-evaluation was significant in models for carpooling, donating to an environmental organization, eating vegetarian one day a week, choosing pasture-raise meat or eggs, and setting water heater temperature. This means that participants who reported they were more likely to evaluate a behavior negatively were in most models more like to "currently do" the behavior than the other categories of adoption. Guilt-repair, which also relates to guilt, had a similar effect in the models where it as significant.

Gender was included in several models but was significant at the .05 level in fewer.

Female participants were more likely to respond "currently do" than "could do but don't" for line-drying laundry and both vegetarian PEBs: eating vegetarian for one day week or choosing a vegetarian meal over beef. On the other hand, women were more likely to respond they could not drive or purchase a fuel-efficient vehicle, set a water heater to 120° F, or weatherstrip.

Education was significant in both vegetarian PEBs. Participants with higher education were more likely to respond "currently do" to both vegetarian PEBs. They were also more likely to respond "could do but don't" to carpooling.

Voting, signing a petition, protesting, donating, and writing government—activism behaviors— had the highest R^2 values. Depending on the behavior and pseudo R^2 test (McFadden or Cox-Snell), the R^2 values range from .12 - .22% or .25 - .41. These study responses were from approximately one month before the first COVID-19-related stay-at-home orders in the US and three and a half months before widespread Black Lives Matter protests during the summer of 2020. Although studies have drawn on moral foundations to explain American culture wars, and moral foundations are correlated with political identity, only purity was significant in any of the activism models—voting for a pro-environmental policy (Koleva et al., 2012).

Participants with higher purity values were less likely to respond that they currently vote on environmental policies. Purity was significant for all three food PEBs. Participants were more likely to indicate that they were planning to eat a vegetarian meal over a beef meal. They were less likely to indicate that they were planning to choose pasture-raised eggs or meat, meaning participants with high purity foundations were more likely to have chosen "currently do" than planning to do. Given that pasture-raised food could conjure images of pristine rural landscapes or farm-fresh cuisine, it could resonate with purity moral foundations. However, higher purity foundations were also correlated with more participants responding that they "could not" eat vegetarian for one day a week and choose pasture-raised meat or eggs.

		Predictor Variable	Comparing "currently do" (1) to "could do but don't" (2) *Coefficient, 95% CI (Upper, Lower)*	Comparing "currently do" (1) to "could do and planning to" (3) *Coefficient, 95% CI (Upper, Lower)*	Comparing "currently do" (1) to "could not do" (4) *Coefficient, 95% CI (Upper, Lower)*
Walk/cycle	MF R^2: 0.07 CS R^2: 0.16	Age	0.99 (0.97, 1.02) ns	0.95 (0.91, 0.98) **	1.04 (1.02, 1.07) **
		Self-efficacy	0.58 (0.40, 0.83) **	0.54 (0.33, 0.89) *	0.60 (0.42, 0.87) **
		Negative behavior-evaluation	0.91 (0.74, 1.12) ns	1.29 (0.96, 1.73) .	1.21 (0.94, 1.56) ns
Carpool	MF R^2: 0.08 CS R^2: 0.20	Age	1.03 (1.00, 1.06) *	1.03 (0.99, 1.07) ns	1.07 (1.04, 1.10) **
		Education	1.38 (1.08, 1.76) **	1.28 (0.92, 1.79) ns	1.17 (0.94, 1.46) ns
		Self-efficacy	0.48 (0.30, 0.76) **	0.63 (0.34, 1.17) ns	0.47 (0.30, 0.72) **
		Negative behavior-evaluation	0.74 (0.58, 0.95) *	0.74 (0.53, 1.03) .	0.89 (0.69, 1.13) ns
Fuel-efficient vehicle	MF R^2: 0.06 CS R^2: 0.14	Gender	0.91 (0.51, 1.62) ns	0.98 (0.53, 1.80) ns	2.03 (1.11, 3.70) *
		Age	0.98 (0.95, 1.00) *	0.96 (0.94, 0.99) **	0.97 (0.94, 0.99) **
		Income	1.08 (0.90, 1.29) ns	0.98 (0.80, 1.19) ns	0.78 (0.64, 0.95) *
		Political identity	0.70 (0.53, 0.92) **	0.89 (0.66, 1.20) ns	0.82 (0.61, 1.11) ns
		BEP	1.24 (0.87, 1.76) ns	2.00 (1.25, 3.19) **	0.93 (0.65, 1.35) ns
Line dry	MF R^2: 0.04 CS R^2: 10	Gender	0.45 (0.26, 0.78) **	0.49 (0.21, 1.14) .	0.62 (0.34, 1.13) ns
		Age	0.99 (0.97, 1.01) ns	0.99 (0.96, 1.03) ns	1.02 (1.00, 1.05) .
		BEP	0.71 (0.49, 1.01) .	0.92 (0.53, 1.59) ns	0.64 (0.44, 0.92) *
		Purity	0.88 (0.71, 1.09) ns	1.03 (0.75, 1.41) ns	0.76 (0.60, 0.96) *
		Guilt-repair	1.30 (0.99, 1.71) .	1.46 (0.93, 2.27) .	1.00 (0.76, 1.32) ns
Energy-efficient water heater Weatherstrip	MF R^2: 0.05	Gender	0.82 (0.48, 1.39) ns	1.00 (0.55, 1.82) ns	2.50 (1.15, 5.45) *
		Age	0.96 (0.93, 0.98) **	0.98 (0.95, 1.00) .	0.94 (0.91, 0.97) **
		Self-efficacy	0.69 (0.49, 0.97) *	1.47 (0.95, 2.28) .	0.53 (0.32, 0.87) *
	McFadden R^2: 0.08 Cox Snell R^2: 0.20	Gender	0.65 (0.36, 1.18) ns	0.51 (0.26, 1.03) .	1.63 (0.92, 2.88) .
		Age	0.97 (0.94, 0.99) **	1.00 (0.97, 1.03) ns	0.96 (0.94, 0.99) **
		Income	1.06 (0.89, 1.28) ns	0.91 (0.73, 1.13) ns	0.81 (0.67, 0.97) *
		Political identity	1.37 (1.03, 1.82) *	1.29 (0.94, 1.79) ns	1.69 (1.27, 2.25) **
		Self-efficacy	0.48 (0.31, 0.75) **	1.17 (0.68, 2.00) ns	0.36 (0.23, 0.55) **
		Shame-withdraw	1.36 (1.10, 1.69) **	1.07 (0.83, 1.38) ns	1.13 (0.91, 1.40) .
Water heater 120° F	McFadden R^2: 0.12 Cox Snell R^2: 0.26	Gender	0.80 (0.46, 1.37) ns	0.71 (0.32, 1.62) ns	2.90 (1.49, 5.64) **
		Age	0.95 (0.93, 0.98) **	0.98 (0.94, 1.01) ns	0.94 (0.92, 0.97) **
		Income	1.06 (0.90, 1.26) ns	0.98 (0.76, 1.27) ns	0.74 (0.59, 0.92) **
		Political Identity	1.44 (1.10, 1.88) **	1.23 (0.84, 1.79) ns	1.56 (1.13, 2.16) **
		Self-efficacy	0.40 (0.26, 0.61) **	1.20 (0.60, 2.37) ns	0.37 (0.22, 0.61) **
		Shame-withdraw	1.23 (1.01, 1.50) *	1.40 (1.06, 1.86) *	1.06 (0.83, 1.35) ns
		Negative behavior-evaluation	0.85 (0.68, 1.05) ns	0.69 (0.50, 0.95) *	0.80 (0.62, 1.03) .
Vegetarian day	MF R^2: 0.09 CS R^2: 0.21	Gender	0.48 (0.29, 0.79) **	0.98 (0.50, 1.93) ns	0.76 (0.36, 1.58) ns
		Age	0.97 (0.95, 0.99) **	0.98 (0.95, 1.01) ns	0.97 (0.94, 1.00) .
		Education	0.79 (0.65, 0.96) *	0.96 (0.72, 1.26) ns	0.65 (0.49, 0.87) **
		Self-efficacy	0.51 (0.36, 0.73) **	1.13 (0.67, 1.89) ns	0.39 (0.24, 0.64) **
		Purity	1.18 (0.98, 1.43) .	1.26 (0.97, 1.63) .	1.57 (1.15, 2.13) **
		Guilt-repair	0.74 (0.54, 1.01) .	0.72 (0.49, 1.07) ns	0.65 (0.43, 0.99) **
		Negative behavior-evaluation	1.37 (1.05, 1.79) *	0.96 (0.68, 1.36) ns	0.96 (0.66, 1.39) ns
Vegetarian over beef meal	McFadden R^2: 0.12 Cox Snell R^2: 0.26	Gender	0.39 (0.23, 0.68) **	0.65 (0.32, 1.33) ns	0.74 (0.34, 1.60) ns
		Age	0.96 (0.94, 0.98) **	098 (0.95, 1.01) ns	0.97 (0.94, 1.00) *
		Education	0.69 (0.56, 0.85) **	0.82 (0.61, 1.10) ns	0.64 (0.47, 0.86) **
		Political Identity	0.96 (0.72, 1.27) ns	1.40 (0.93, 2.11) ns	0.62 (0.42, 0.93) *
		BEP	0.51 (0.35, 0.74) **	1.02 (0.57, 1.83) ns	0.54 (0.34, 0.87) *
		Purity	1.15 (0.92, 1.44) ns	1.53 (1.13, 2.08) **	1.30 (0.93, 1.84) ns

Pasture-raised eggs or meat		Negative behavior-evaluation	1.11 (0.89, 1.39) ns	0.84 (0.63, 1.13) ns	0.88 (0.64, 1.20) ns
	McFadden R^2: 0.07 Cox Snell R^2: 0.15	Income	0.96 (0.81, 1.12) ns	1.01 (0.82, 1.23) ns	0.70 (0.53, 0.92) *
		Self-efficacy	0.54 (0.39, 0.74) **	0.97 (0.61, 1.54) ns	0.66 (0.41, 1.06) .
		Purity	0.97 (0.80, 1.17) ns	0.76 (0.60, 0.96) *	1.36 (1.00, 1.85) *
		Guilt-repair	0.77 (0.57, 1.05) .	0.62 (0.42, 0.93) *	0.97 (0.62, 1.53) ns
		Shame-withdraw	1.03 (0.85, 1.24) ns	1.29 (1.03, 1.62) *	1.13 (0.85, 1.51) ns
		Negative behavior-evaluation	0.89 (0.70, 1.14) ns	1.14 (0.81, 1.60) ns	0.69 (0.48, 0.99) *
Donate	McFadden R^2: 0.13 Cox Snell R^2: 0.30	Education	1.03 (0.81, 1.30) ns	0.77 (0.59, 1.01) .	0.88 (0.64, 1.21) ns
		Income	0.89 (0.74, 1.07) ns	0.99 (0.80, 1.23) ns	0.64 (0.48, 0.85) **
		Self-efficacy	0.26 (0.16, 0.41) **	0.66 (0.38, 1.14) ns	0.11 (0.06, 0.19) **
		Shame-withdraw	0.96 (0.78, 1.18) ns	1.27 (1.01, 1.58) *	0.98 (0.73, 1.33) ns
		Negative behavior-evaluation	0.76 (0.61, 0.95) *	0.84 (0.64, 1.10) ns	0.61 (0.45, 0.82) **
Protest	MF R^2: 0.12 Cox Snell R^2: 0.25	Age	1.05 (1.01, 1.09) *	1.04 (1.00, 1.09) *	1.06 (1.01, 1.10) **
		Political Identity	0.80 (0.55, 1.18) ns	0.93 (0.59, 1.45) ns	0.61 (0.40, 0.92) *
		Self-efficacy	0.24 (0.11, 0.5) **	0.82 (0.34, 2.01) ns	0.15 (0.07, 0.34) **
		Shame-withdraw	0.94 (0.71, 1.23) ns	1.41 (1.03, 1.93) *	1.10 (0.80, 1.50) ns
		Negative self-evaluation	1.25 (0.94, 1.66) ns	0.92 (0.66, 1.27) ns	1.29 (0.93, 1.80) ns
Write Gov	MF R^2: 0.13 CS R^2: 0.25	Age	0.97 (0.95, 1.00) .	0.97 (0.94, 1.01) ns	1.00 (0.96, 1.03) ns
		Education	1.03 (0.77, 1.38) ns	0.75 (0.54, 1.06) ns	1.03 (0.72, 1.47) ns
		Political identity	0.66 (0.45, 0.96) *	0.74 (0.48, 1.15) ns	0.43 (0.27, 0.67) **
		Self-efficacy	0.53 (0.28, 1.00) .	1.76 (0.78, 3.97) ns	0.35 (0.17, 0.72) **
		Guilt-repair	1.24 (0.87, 1.75) ns	1.11 (0.72, 1.71) ns	0.82 (0.54, 1.23) ns
		Shame-withdraw	1.19 (0.89, 1.58) ns	1.61 (1.16, 2.23) **	1.17 (0.82, 1.67) ns
Petition	MF R^2: 0.13 CS R^2: 0.29	Gender	0.63 (0.37, 1.07) .	1.12 (0.58, 2.18) ns	1.65 (0.71, 3.85) ns
		Education	1.15 (0.93, 1.42) ns	0.87 (0.67, 1.13) ns	1.03 (0.74, 1.43) ns
		Political Identity	0.75 (0.58, 0.97) *	0.83 (0.60, 1.14) ns	0.45 (0.29, 0.68) **
		Self-efficacy	0.31 (0.19, 0.50) **	0.61 (0.34, 1.09) .	0.15 (0.08, 0.28) **
		Guilt-repair	0.85 (0.65, 1.11) ns	0.72 (0.52, 0.99) *	0.65 (0.44, 0.96) *
Vote	MF R^2: 0.22 CS R^2: 0.40	Political Identity	0.68 (0.50, 0.94) *	0.97 (0.69, 1.35) ns	0.39 (0.23, 0.65) **
		Self-efficacy	0.19 (0.11, 0.31) **	0.51 (0.29, 0.87) *	0.10 (0.05, 0.21) **
		Purity	1.41 (1.07, 1.85) *	1.55 (1.18, 2.04) **	1.43 (0.94, 2.18) .
		Guilt-repair	0.77 (0.58, 1.04) .	0.71 (0.53, 0.95) *	0.44 (0.29, 0.68) **

** $p < 0.01$ * $p < 0.05$ · $p < 0.10$ ns = not significant

Table 5: Multinomial Regression for Level of Behavior Adoption

Models predicted the level of PEB adoption with a multinomial logistic regression with a four-level response. Red indicates an odds ratio less than one, and green indicates above one.

Question 2

Linear Regression

The linear model with the lowest AIC had six significant variables (Table 6). Age, gender, self-efficacy, and guilt-repair were positively and significantly correlated to the number of PEBs participants adopted, while shame withdrawal and purity were significantly negatively correlated to the number of behaviors participants adopted. The mean number of behaviors adopted by participants was 7.40, 95% CI [7.05, 7.74].

Age is often not associated with performing PEBs, and when it is, younger age would usually be associated with concern or belief in climate change. However, in this model, the coefficient is small but positive, indicating approximately 20 years of additional age is associated with the adoption of one additional behavior.

Coefficients:	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	-0.60	1.19	-0.51	0.61
Gender	0.55	0.31	1.77	0.08 .
Age	0.05	0.01	4.03	0.00 ***
Self-efficacy	1.84	0.20	9.11	0.00 ***
MFQ purity	-0.17	0.11	-1.54	0.13
GASP guilt-repair	0.36	0.15	2.38	0.02 *
GASP shame-withdrawal	-0.38	0.12	-3.26	0.00 **
Signif. codes: '***' 0.001, '**' 0.01, '*' 0.05, '.' 0.1				
Residual standard error: 2.92 on 380 degrees of freedom Multiple R-squared: 0.26, Adjusted R-squared: 0.25 F-statistic: 22.41 on 6 and 380 DF, p-value: < 2.2e-16				

Table 6: Linear regression for Number of Behaviors Adopted
Results explain 25% percent of the variance in the number of behaviors adopted by participants.

Perhaps the most notable inclusions in the model were two variables from the GASP scale in opposite directions. As in the multinomial regressions, guilt-repair was positively associated with the adoption of more behaviors. Shame withdrawal was associated with a greater likelihood of a participant choosing an adoption category other than "currently do" in the multinomial regressions. Similarly, it was associated with adopting fewer behaviors in the linear regression. Overall, the model explained 25% of the variance in number of behaviors participants adopted ($F(6, 380) = 22.41$, $p < 0.001$, Adj. $R^2 = 0.25$).

Conditional Forest

A random seed in a conditional inference tree generates multiple models with the same data, which brings about the final model, the random forest. A random forest is essentially an average of multiple runs of a conditional inference tree to generate a more stable model (Cutler & Wiener, 2018). Conditional inference trees are a non-parametric regression tree that can accommodate small sample sizes and produce accurate estimates (Biau & Scornet, 2015). Each tree grows with a random sample and replacement, referred to as out-of-bag (OOB) observations. Each tree also randomly selects predictor variables for each splitting node (L. Cheng et al., 2019). By randomly selecting variables, the random forest algorithm accounts the for the decrease in the accuracy of the model between inclusion and exclusion of each variable. A greater drop in accuracy reflects greater importance of the variable (Wang et al., 2018). In this case, the forest had 2000 trees to ensure a stable model.

Of the top five variables it identified, four were in the linear regression: self-efficacy, age, guilt, and shame withdrawal. Brief Ecological Paradigm was also an important variable but not in the linear regression since it was highly correlated with self-efficacy. Purity, although not significant, is in the linear regression and shows a low level of importance in the conditional

forest. The conditional forest model explained 21% of variance in the number of PEBs adopted by participants. See Figure 13 for the variables by importance.

Discussion

Differences between adoption levels

The results of this study supported some of the initial hypotheses. Self-efficacy and environmental attitudes, negative behavior evaluation, education, liberal political identity, and female gender mostly followed the predicted positive relationship with the adoption category "currently do" (hypothesis 1.1). The effects of shame withdrawal, male gender, and conservative political identity were also generally in the predicted negative direction (hypothesis 1.2).

A few variables were notable exceptions. Participants with high purity moral foundations were more likely to choose "could do but don't." In chapter 2 of this dissertation, participants with higher moral foundations were more likely to have adopted PEBs after receiving moral messaging, even if the participant had higher purity rather than harm moral foundations. Yet, other studies indicate that moral foundations help explain culture war issues, such as global warming (Koleva et al., 2012). Thus, while the effect of purity was not in the predicted direction, the result is also not surprising.

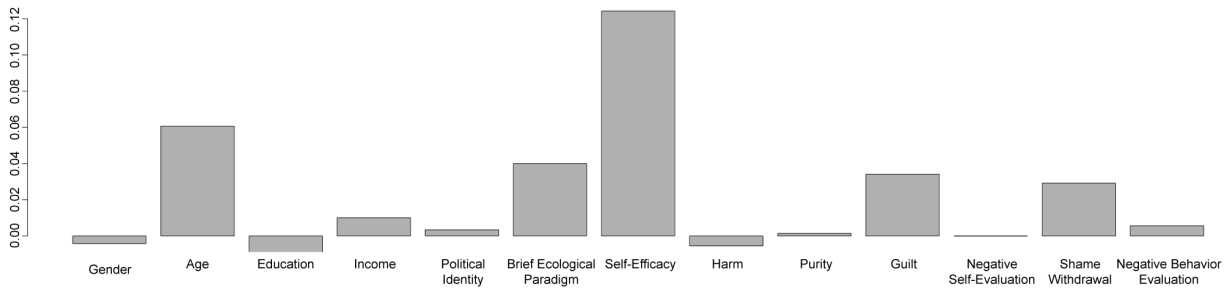


Figure 13: Conditional Forest Model
Bars represent the importance of variables in the conditional forest model. The model explains an estimated 21% of the variance.

Some of the GASP and moral foundations variables were not significant. Guilt-repair was not significant at the .05 level in the logits representing the difference between participants who "currently do" PEBs and those who "could but don't." Harm foundations and negative self-evaluation were not significant for any of the logits for any behavior. In the case of harm, it is possible this is related to political conservatives valuing moral foundations more evenly and liberals favoring harm and fairness in particular (Graham et al., 2009; Koleva et al., 2012). Thus, harm may not be a differentiating predictor because groups hold it more evenly. The differences would be in purity foundations, as seen in this study's results.

Switching to the logit comparing participants who "could not do" a behavior to those who "currently do," these groups differed on age and income as hypothesized (1.3). Higher income was consistent with lower odds of choosing "could not do," but age worked in both directions. Age was also an important predictor in all of the models, which is surprising since it is not consistently significant in studies predicting PEB intention (McCright et al., 2016). These results could reflect that many of the PEBs in this study are related to household behaviors, which younger people have not yet pursued. It is also possible that with the study's slightly younger and more liberal demographic that participants in this study are not fully representative of the country. With few people above age 60, the model might be inaccurate for older people.

In previous work, the relationship between moral norms and intention was stronger in older participants. However, after controlling for the variables in Theory of Planned Behavior, it was not more predictive of behavior (Rivis et al., 2009). The effect of age is small in the linear regression in this study. In addition to better representation of older people, perhaps if norms from of Theory of Planned Behavior had been included, the results would have more closely resembled those of Rivis et al. (2009), removing the influence of age from the models.

Other variables were also significant in the difference between "currently do" and "could

not do." Political identity was often significant in this category, but none of the variables were in more models than self-efficacy. Predictably, based on Theory of Planned Behavior and the multinomial regressions, self-efficacy was the strongest predictor in the linear regression. Substantial theory and evidence support the role of self-efficacy in PEB (Armitage & Conner, 2001; Bandura, 1977; Hamann & Reese, 2020; Harland et al., 1999; Kellstedt et al., 2008). In this study, self-efficacy and Brief Ecological Paradigm were highly correlated. However, self-efficacy was the stronger predictor. Yet, participants who are planning to perform a behavior differed less in self-efficacy from participants who "currently do" than predicted (hypothesis 1.4). Purity, guilt-repair, shame withdrawal, and age were all significant in more models for the planning category of adoption than self-efficacy.

Differences between behavior types

Self-efficacy was significant in almost all of the models. Based on a prior study, it was specifically hypothesized (2.2) that self-efficacy be significant to transportation behaviors (Heath & Gifford, 2002). Transportation, in fact, was not an exception. Self-efficacy or the correlated Brief Ecological Paradigm were significant in all of the transportation models that had enough responses for analysis. Although Brief Ecological Paradigm rather than self-efficacy was significant in the model for driving a fuel-efficient vehicle, the two measures were correlated. More isolated measures would help differentiate to what extent they are both measuring self-efficacy or environmental attitudes.

Overall, the behaviors participants were already currently doing did not represent a particular behavior type more than the others (hypothesis 2.1). A previous study found that shifts in consumption, such as shifts in diet in this study were the least acceptable to participants. Energy measures, on the other hand were more acceptable than transportation and consumption

measures (Poortinga et al., 2003). In this study, combining errands, installing energy efficient lighting, and maintaining tire pressure each had such a large majority in the "currently do" category that it was not possible to conduct analysis on the differences between adoption categories. Two were transportation behaviors, and efficient lighting was an energy behavior. Many participants also currently weatherstrip and vote, which are energy and activism behaviors. Since the behaviors are just a sample of PEBs that could be adopted, it is not possible to conclude that any category definitively had more adoptions than others. The distributions may depend on several factors, including contextual factors that are not included in this study.

One noticeable pattern was that four of the activism behaviors had more participants who responded that they "could do but don't" donate to an environmental organization, protest, write government, or sign petitions for environmental issues than other behaviors. The differences in activism behaviors could be a proxy for participants who live in urban centers versus more rural areas, who have different opportunities available. Some participants commented that they could not participate in activism behaviors because these activities were not happening in their areas. If participants are living in apartments or condominiums, they may have less control over their physical homes and behaviors like adjusting their water heaters. However, participants in urban areas may have greater access to protests, petitions, and environmental policies on which they can vote, especially since urban areas tend to be more liberal (Scala & Johnson, 2017).

Previous research had found that harm and purity were relevant to moral thinking about food (Mäkiniemi et al., 2013). Additionally, moral evaluation and intensity were related to climate-friendly food choices. Specifically, individualizing foundations, including harm, were associated with climate-friendly food choices. Whereas, binding foundations, including purity, were associated with a decrease in climate-friendly choices (Vainio & Mäkiniemi, 2016). As

hypothesized (2.3), moral foundations and GASP variables were significant in food behavior models (Mäkiniemi et al., 2013). Purity, negative behavior evaluation, shame withdrawal, and guilt-repair were significant for at least one category of adoption for choosing pasture-raised meat or eggs. Although guilt-repair and shame withdrawal maintained the inverse relationship seen in other models, the effects of purity and negative behavior evaluation were inconsistent between the three food behaviors. Unexpectedly, harm was not significant in any of the food models.

Furthermore, GASP variables had an unpredicted consistency in the activism behaviors. Guilt-repair or shame withdrawal were significant in models for all of the activism PEBs. Participants with high shame withdrawal had higher odds of choosing a behavior adoption category other than "currently do," while high guilt-repair was associated with higher odds of choosing "currently do." However, the months following this survey included widespread protests as a part of the Black Lives Matter movement around the world in response to police killings of George Floyd, Ahmaud Arbery, and others. Other protests occurred in response to restrictions put in place due to the COVID-19 pandemic. These events could have changed the adoption levels of these activism behaviors among Americans as well as perceptions of these behaviors in relation to an individual's' moral foundations.

Also consistent with hypothesis 2.4, political identity was significant in the odds of currently doing most activism behaviors (Schmitt et al., 2019). Liberal participants were more likely to "currently do" them. The only model in which it was not significant was the donation behavior of the activism type. These results are consistent with prior research that found that a politicized environmental identity is correlated with activism PEBs (Schmitt et al., 2019). However, other research found that the inclusion of Theory of Planned Behavior variables diminished the effect of political identity (Fielding et al., 2008). If this study had included norms,

the results may have been different.

Comparing models

The models for the number of PEBs participants adopted are two perspectives on the same question, and they provide similar answers. The linear regression and conditional forest partially supported hypothesis 2.5. Participants with higher self-efficacy and guilt-repair as well as female gender all were significant in the linear regression in the predicted direction. Environmental attitudes, as measured by Brief Ecological Paradigm, appeared as an important variable in the conditional forest. However, age unexpectedly had a positive correlation to the adoption of behaviors. Purity and shame withdrawal appeared in the regression with a negative relationship to the number of behaviors adopted. Many other variables were not significant in the regression and were of low importance to the conditional forest, such as harm moral foundations, political identity, negative self-evaluation, for example.

Overall, linear regression, conditional forest, and multinomial models were consistent about importance of the variables. Political identity and purity were two notable differences. Political identity was significant in several multinomial models. Yet, it was not significant in the linear regression for the number of PEBs participants had adopted, and it was low on the list of important variables in the random forest model.

This study measured political ideology on a bipolar scale, similar to those used in previous research (Feinberg & Willer, 2013; Graham et al., 2009). Recent research could help explain the differences in the effects of political identity. Although researchers often use ideological descriptors and scales for convenience, political views are not necessarily ideologically consistent on a continuum of liberal to conservative (Broockman, 2016). This could partially explain why political identity was negatively correlated with some behaviors and

positively correlated with others. The mixed directional effects may contribute to why political identity was not significant in the overall number of behaviors adopted.

Purity was included in the linear regression despite having a low level of importance in the conditional forest. It was not significant in the regression, which is consistent with the low importance in the forest. However, similar to the discussion as to why purity appeared in the multinomial models when harm did not, conservatives tend to have more even concern across moral foundations whereas liberals tend to emphasize harm and fairness higher and others, including purity, lower (Graham et al., 2009; Koleva et al., 2012). These differences could lead to a greater difference between the groups on purity rather than harm, which both groups value.

Limitations

This study differs in a few ways from previous studies on PEB adoption. First, the response variable (level of behavior adoption) was a non-ordinal, categorical variable. Most other studies use an ordinal frequency of adoption variable (Blankenberg & Alhusen, 2018). Understanding sociological, psychological, and demographics associated with performing and not performing environmental behaviors in this format is useful because the predictors of type or number of behaviors could influence spillover effects or moral licensing as well (Lanzini & Thøgersen, 2014; Rashid & Wahid, 2012; Truelove et al., 2014). Although the categorical approach allows for a novel analysis by including three options for non-adoption, it also sacrificed predictive power associated with ordinal or numeric responses. Moreover, the choice of baseline category, "currently do" in this case affects the outcomes of the multinomial regressions. Choosing any of the other categories would potentially change which predictors were significant. These particular estimates are representative of the specific models run in this study.

Another notable difference is that the study asked people about their current behavior.

Many other studies of behavior ask about intentions or behavior that the participant might perform in the future. Although participants had the option to respond that they were planning to perform a behavior in the future, the design was not focused on exploring behavioral intention. This structure allows for a focus on predictors of behaviors currently influential for the lifestyle people are living. Some predictors differ between behaviors people currently do and behaviors people are planning to do, as seen in the multinomial regression. Thus, the predictive results of this study are not completely comparable to previous studies of PEBs.

A primary limitation of this study was that one of the three main predictors in Theory of Planned Behavior, subjective norms, was not included. This study was not designed to study social aspects of the adoption of behaviors. However, norms are an influential factor in behavioral decisions (Goldstein et al., 2008; Schultz et al., 2008). Several researchers have called for a re-examining of norms in the context of Theory of Planned Behavior, which could be examined in future research (Armitage & Conner, 2001; Rivis & Sheeran, 2003). The differences in the design of the study and exclusion of norms, could explain the lower explanation of variance than some other studies using Theory of Planned Behavior (Armitage & Conner, 2001; Rivis et al., 2009). Additional research could examine relationships between the predictors of current and future behaviors more in-depth.

Limitations affect the generalizability and the results from this study. First, we recruited participants via mTurk, which is not random sampling. Our participants were younger, whiter, more educated, and more liberal than a representative sample from the country. Although, the sample would ideally be more representative, evidence suggests that mTurk is as valid for recruitment for studies on political ideology, which we had anticipated could be influential in a study relating to environmental issues in the United States (Clifford et al., 2015).

Additionally, the self-efficacy measure was tailored specifically to climate change, which

seems to have made it highly correlated with the environmental attitudes measure. It is possible that the correlation is also related to our choice of using the five-question version of the New Ecological Paradigm survey, affecting the attitudes we were measuring. Regardless, the measures of environmental attitudes and self-efficacy are too closely correlated to be measuring the separate constructs we had intended. Ensuring that self-efficacy and attitudes are measured separately is essential for future studies.

Furthermore, this study investigated the predictors of the level of adoption of PEBs and the number of PEBs adopted by participants in a cross-sectional study. It did not formally collect data on the reasons for participants' decisions, so participants could be describing similar situations with different answers. "Could not do" was a common answer for carpooling or line drying clothes. There are many possible explanations for these patterns of response, and individuals could interpret the barriers as inconvenient ("could do but don't") or impossible ("could not do"), depending on their perspective. People who ride a bus, walk, or bike might not need to carpool, and some participants wrote that their area or with their schedule this behavior was difficult. Housing situations, such as home owners' agreements or weather, made hanging laundry to dry difficult, according to some responses. Since this study provided an option to comment but did not systematically collect information on reasons, the diversity of reasons and interpretations proved difficult to integrate into the analysis.

The lack of additional questions about these decisions also makes some responses difficult to interpret. It is not clear why women had much higher odds of responding they "could not" drive a fuel-efficient vehicle, for example. Additional questions could assist with the interpretation of results. For brevity, this study did not ask about home ownership, number and ages of people in the household, the size of the house, roles in decision-making, commute distance, health issues, and other relevant details. It also did not follow participants over time.

Additional research could selectively add questions that would assist with understanding responses. A longitudinal study could also provide evidence of causal relationships, as opposed to just correlations.

Conclusions

Identifying the differences between PEBs has practical implications. Returning to *The Little Book of Green Nudges* and *Fostering Sustainable Behavior*, individuals and organizations interested in changing behavior one small step at a time need to identify a specific behavior and audience. Of importance in community-based social marketing is determining impact, probability, and penetration (McKenzie-Mohr, 2013). While this study focused on the areas of greatest impact for the average individual, behaviors with high penetration, such as maintaining tire pressure, present less opportunity for investment from a behavior-change perspective. It revealed opportunities in other areas, such as it appears that fuel-efficient vehicles had a higher number of participants planning to perform the behavior. Additionally, activism behaviors showed a different kind of potential with high numbers of participants responding "could do but don't."

These results also support tailoring the intervention to the behavior. Income is influential to purchasing or using a fuel-efficient vehicle, but other factors are important to eating vegetarian one day per week or writing the government about an environmental issue. Identifying these differences is important to developing a strategy. For example, proposing a financial solution to financial barriers or a more convenient alternative for an inconvenience behavior could maximize potential for behavior adoption. Understanding unique qualities of behaviors could also assist with effectively communicating ideas to specific audiences.

As humans continue to shape their surroundings, whether domesticating pets or lighting

the sky at night, this study supports research into how each behavior has its own constellation of predictors. At the core of this study were questions about the variables influencing different PEBs. The variables differed between behaviors, which was expected. However, the variation exceeded expectations with variation between even very similar behaviors, such as eating a vegetarian meal and eating vegetarian one day a week. Self-efficacy was the most consistent predictor in the multinomial regressions and the most influential in the linear regression and conditional forest.

Additionally, the GASP variables, guilt-repair and shame withdrawal, are promising measures of moral aspects of environmental behavior. Guilt-repair and shame withdrawal were two of just four variables in the regression predicting the number of PEBs participants had adopted. They appear to have a role in the difference between performing a behavior and planning to perform a behavior. Additionally, they influence decisions participants make about food.

Finally, participants completed the survey for this study prior to the response to COVID-19 in the United States and the rise of protests in support of Black Lives Matter, which have already radically changed the ways people interact with the world. Yet, these events have not only changed the default operations, they have changed the ways people think and set their priorities. Some behaviors, like carpooling, are at least temporarily irrelevant, either because people do not need to commute or because it is not safe to be in a car with another person. Others, like protesting, petitioning, and writing a government official have new found significance. Environmental decision makers and communicators are constantly balancing broad scale and individual changes. Even high-level changes benefit from or even are driven by activism behaviors. Although the influence of variables, especially moral ones, may ebb and flow over time. The variables significant to environmental decisions broadly are likely to endure.

CHAPTER 4

WHO IS RESPONSIBLE HERE?

ADOPTION OR DEFERRAL OF PRO-ENVIRONMENTAL BEHAVIORS

Highlights

- Most participants attributed responsibility to themselves.
- Attributions of responsibility differed between environmental behaviors.
- Self-efficacy distinguished "not interested" and not "under current circumstances" responses.

Abstract

Attribution of responsibility both for causing and addressing environmental issues is a common topic of conversation from the dinner table to international negotiations. This study investigated who participants perceived as responsible for environmental behaviors when they chose not to personally pursue further personal action. Using an mTurk survey sample, the results indicated that most people who could but do not perform pro-environmental behaviors attributed responsibility to themselves and that self-efficacy was an important factor in this decision. The study also investigated environmental attitudes, guilt and shame proneness, moral foundations, political affiliation, and demographics as predictors. Policy implications stemming from these findings are discussed.

Keywords

Attribution of Responsibility, Environmental communication, Pro-environmental Behavior

Introduction

"What are you willing to change to help reduce emissions? #EnergyDebate" (Shell, 2020)

"UNLESS someone like you cares a whole awful lot, nothing is going to get better. It's not." (Geisel, 1971)

The Lorax, the popular children's story, ends with the message that motivated individuals, "like you," need to do something to improve the environment. Decades later, Shell, a petrochemical company agrees, but not everyone does. When Shell posted a poll on Twitter inquiring what individuals would do to reduce emissions, it received only a couple hundred votes but thousands of comments in addition to media coverage (Carrington, 2020).

Climate activist Greta Thunberg replied, "I don't know about you, but I sure am willing to call-out-the-fossil-fuel-companies-for-knowingly-destroying-future-living-conditions-for-countless-generations-for profit-and-then-trying-to-distract-people-and-prevent-real-systemic-change-through-endless greenwash-campaigns" (Thunberg, 2020).

Climate scientist Katharine Hayhoe replied, "What am I willing to do? Hold you accountable for 2% of cumulative global GHG emissions, equivalent to those of my entire home country of Canada. When you have a concrete plan to address that, I'd be happy to chat about what I'm doing to reduce my personal emissions" (Hayhoe, 2020).

The comments on Shell's tweet reflected a larger conversation on who is responsible for greenhouse gas emissions or environmental action. In his essay, *Individualization: Plant a Tree, Buy a Bike, Save the World?*, Maniates argues that, "privatization and individualization of responsibility for environmental problems shifts blame from State elites and powerful producer

groups to more amorphous culprits like 'human nature' or 'all of us'" (Maniates, 2001). Who, then, is responsible for addressing the most significant environmental problem of our time, climate change?

Background

In the fall of 2018 and spring of 2019, we tested the effects of carbon calculator interventions on individual pro-environmental behavior (PEB). The analysis revealed no measurable change in electrical consumption and minimal changes in PEB. As it turns out, the participants in this study were not alone in their inaction. A 2018 study in the United Kingdom reported similar results after conducting a more intensive intervention involving 60-90 minute carbon calculator interviews (Büchs et al., 2018). The researchers followed up on participants' behavior for two years. The results indicated that the carbon calculator increased awareness of actions and concern about climate change, but it did not change self-reported behavior in energy or travel (Büchs et al. 2018). However, when the researchers asked participants about making further change, many participants reached a point where they were unwilling to change additional behaviors. According to the researchers, "The vast majority in our sample of those who regularly engaged in air travel thus explicitly stated they were unwilling to reduce it. And those who regularly consume meat often perceive it as a necessary part of their diet, or enjoy it so much, that they cannot imagine to reduce it or even give it up" (Büchs et al. 2018).

Clearly, the carbon calculator and moral foundations interventions had limits to their motivational value, and it is not just carbon calculator studies that find a disparity between values, attitudes, and behaviors. Research has documented the gaps well. People may have values that fail to translate to behavior—value-action gap—or behaviors that fail to have substantial environmental impact—behavior-impact gap (Blake, 1999; Csutora, 2012; Kollmuss &

Agyeman, 2002; Moser & Dilling, 2011; Tabi, 2013). Indeed, environmental concern leaves much of the variance in behavior unexplained (Bamberg, 2003; Gatersleben et al., 2002; Hines et al., 1987; Rees & Bamberg, 2014; Stern, 2000). Attitudes, subjective norms, and perceived behavioral control or self-efficacy together, the components of Theory of Planned Behavior, explain 27% of the variance in behavior (Armitage & Conner, 2001; Bamberg & Möser, 2007).

Attitudes about the environment or about a specific behavior, such as reluctance to change air travel or diet as exemplified by the quotes of the participants in the Büchs et al. (2018) study, are a component of Theory of Planned Behavior and thus an important predictor of PEB (Ajzen, 1991; Barr et al., 2010; S. A. Cohen et al., 2013; Hartmann & Siegrist, 2017; Kroesen, 2013; Latvala et al., 2012; McKercher & Prideaux, 2011). To include environmental attitudes as a potential predictor of responsibility attribution, participants completed a brief version of the New Ecological Paradigm (NEP) questionnaire, one of the most common measures of environmental attitudes (Dunlap et al., 2000; López-Bonilla & López-Bonilla, 2016).

Another important aspect of inaction could be the effort or perceived effort to perform the behavior (Diekmann & Preisendörfer, 2003; Miafodzyeva & Brandt, 2013). Effort is a moderator of the relationship between attitude and PEB, so pro-environmental attitudes are positively related to the level of effort a person is willing to undertake for a behavior (Schultz & Oskamp, 1996). However, people may perceive limits to the effectiveness of their choices. For example, a study of consumers in the United States and United Kingdom found 75% of respondents were, "concerned about global warming but challenged to see how their action could make a difference" (Forstater et al., 2007).

People have good reason to believe that the impacts of their behaviors are limited. After the shutdowns brought about by the COVID-19 pandemic, global emissions dropped by 17% (Le Quéré et al., 2020). Yet, this extraordinary and temporary reduction, which included many people

working and schooling from home and avoiding air travel, is well below the recommended reduction of 45% below 2010 emission levels by 2030 (IPCC, 2018). Still, self-efficacy is a predictor of PEB and was included in this study as a potential predictor of responsibility attribution. Participants completed a three-question, climate specific questionnaire to measure self-efficacy (Kellstedt et al., 2008).

Individuals and the systems that they build and operate are responsible for emissions and emission reductions. Whether people change individual behavior or systems that influence behavior, change is required to reduce anthropogenic global warming and mitigate the risks of climate change. Current practices have not reduced emissions enough to achieve targets set by the Intergovernmental Panel on Climate Change (IPCC, 2018). If people reach a point at which they choose not to take further action, then the question remains about who or what is responsible. It is possible people believe they personally are responsible, so when they choose to not pursue behavior, no more environmental progress will take place. Perhaps people prefer that businesses, non-profits, or governments take responsibility for efforts on specific issues in ways that individuals cannot.

Responsibility

Responsibility refers to accountability and restitution. The first part or causal responsibility refers to the burden of the party that instigated or initiated events. Whereas, treatment responsibility refers to the burden of party who is responsible for mitigation or reparations (Iyengar, 1994). These two sides of responsibility also influence the actions people will take to address the issue (Jang, 2013; Kent, 2009; H. Kim et al., 2019; S.-H. Kim, 2015).

However, with a large-scale issue with diffuse causes like climate change, attribution of responsibility is challenging. For example, manufacturing and driving cars can contribute to

climate change and leave environmental damage across the globe. The consumer, dealer, manufacturers, mining operators, governments, land owners, and many more people and organizations participate in the process. Attributing causal and treatment responsibility is an expansive task. Adding to the complexity of the situation, people prefer not to be the responsible entity.

With so many players from the local to international level, opportunities to deflect responsibility are readily available. Given the opportunity, people are more likely to attribute treatment responsibility to an out-group with perceived causal responsibility than an in-group (P. Cheng et al., 2017). For example, a study found Americans were more likely to attribute climate change to natural causes when they read an article referencing energy use in the United States (in-group) than when reading an article that referenced China's energy use (out-group) (Jang, 2013). It is possible that attributing climate change to uncontrollable circumstances is a form of denial to avoid the assumption of causal responsibility and therefore treatment responsibility as well (Doherty & Clayton, 2011)

The scale and diffuse causes of environmental issues also make moral accountability challenging (Adger et al., 2017; Markowitz & Shariff, 2012). Yet, responsibility remains an important topic in addressing climate change because feelings of personal moral responsibility are associated with willingness to adopt preventative or corrective measures (P. Cheng et al., 2017; Kaiser & Shimoda, 1999). Some studies also find that communications drawing on morality to discuss environmental issues may persuade people to adopt pro-environmental behaviors. Harm and purity foundations in particular are associated with liberals and conservatives, respectively (Graham et al., 2009; Koleva et al., 2012). Matching these appeals to political beliefs has in some contexts increased PEBs (Feinberg & Willer, 2013; Kidwell et al., 2013; Wolsko, 2017).

Guilt and shame may also play a role in the adoption of behaviors. Exposing people to

information that their carbon footprint or that their country's carbon footprint is higher than others increased feelings of guilt, which can motivate behavior (Mallett et al., 2013). Another study examined both guilt and shame, finding that shame motivated PEB (Amatulli et al., 2019). A third study found that both guilt and shame increased environmental attitudes and intention to perform PEBs (Baek & Yoon, 2017). Guilt is also related to feelings of responsibility (Kaiser & Shimoda, 1999). Thus, the Guilt and Shame Proneness (GASP) scale was also included in the analysis to investigate the relationship between guilt, shame, and PEBs (T. R. Cohen et al., 2011).

GASP consists for four subscales. Two of the subscales are associated with guilt. Guilt-repair focuses on reparations for a private action, whereas negative behavior evaluation focuses on a perception of a private behavior. The guilt subscales positively correlate with one other and have an inverse relationship with unethical decision making (T. R. Cohen et al., 2011). The other two subscales are associated with shame. Shame withdrawal focuses on withdrawing from a shameful public action, whereas negative self-evaluation reflects feelings about a public situation. The shame subscales are weakly and positively correlated. The subscales also appear to have differing relationships to unethical decision making. While negative self-evaluation constrained it in prior research, shame-withdrawal did not (T. R. Cohen et al., 2011).

While individuals make many decisions about environmental behaviors in day-to-day life, attributing responsibilities entirely to individuals ignores roles played by governments, businesses, non-profits, and others. From over 30 years of survey data, American youth showed their belief in government responsibility positively reflected their attitudes toward personal responsibility. They tend to view environmental issues as a collective responsibility (Wray-Lake et al., 2010). A study in the United Kingdom indicated participants identified a role for government leadership when they perceived that individual actions were ineffective when considering the inaction of others. Participants acknowledged the necessity of trusting expertise

while still questioning the accuracy of projections and models (Bickerstaff et al., 2008). Indeed, attributing responsibility to other people or groups, externalizing it, is a perceived barrier to engaging with environmental action for individuals (Lorenzoni et al., 2007). Likewise, another perceived social barrier is that industry or business should take the lead (Lorenzoni et al., 2007). Discouragingly, other researchers have found that even advocating for individual behavior change can cause individuals to express that they are less likely to adopt behaviors and acknowledge the acceleration of climate change (Palm et al., 2020)

Individual and organizational responsibility are not mutually exclusive, however, and individual preferences could differ by environmental issue. For example, consumer actions, like buying efficient light bulbs, and individual actions, like turning off the lights, are fundamentally different. As economic propositions, the former costs money initially while the second saves it. A person could embrace one and not the other and have differing opinions about the role of businesses or governments to take responsibility for each. A person could also embrace or reject individual behaviors regardless of their feelings on government responsibility for environmental action in general (Soneryd & Uggla, 2015).

This study looks beyond the willingness of individuals to adopt personal behaviors to ask, if an individual chooses not to adopt a behavior, then who is responsible? Shove (2010) proposed to, "reopen a set of basic questions about the role of the state, the allocation of responsibility, and in very practical terms the meaning of manageability, within climate-change policy" (p. 1283). Many researchers have studied people's failure to translate knowledge to social action, especially given the amount of concern individuals report (e.g. Kollmuss & Agyeman, 2002; Moser & Dilling, 2011; Naustdalslid, 2011; Rees & Bamberg, 2014). This study asks people who should take on climate action once they, as individuals, will not pursue further action.

The results could inform policy decisions and actions pursued by businesses, non-profits,

governments, and environmental communicators. These organizations and people are in the position of pursuing large-scale environmental change on behalf of citizens and customers or encouraging people to pursue PEBs themselves. The results reveal which factors influence decisions to pursue behaviors personally and whether people would prefer another organization continue those efforts.

Research question

Q1. For people who could perform a PEB and do not, which factors influence a person's decision to…

- Choose to do nothing more?
    a. I choose not to pursue it and am not interested.
    b. I choose not to pursue it under current circumstances.
- Defer to another organization (government, non-profit, or business)?
    c. BUSINESSES should spearhead ways to address this issue.
    d. NON-PROFITS should spearhead ways to address this issue.
    e. GOVERNMENTS should spearhead ways to address this issue.

H1.1 Since externalizing responsibility is a common barrier to climate action, over half of participants will select another organization as the party responsible to address PEBs (Lachapelle et al., 2012; Lorenzoni et al., 2007).

H1.2 Participants choosing "I choose not to pursue it under current circumstances," will be more similar to participants who currently do the behavior. Therefore, higher self-efficacy, environmental values, level of

education, and income, as well as, female gender and liberal political identity will be associated with higher odds of choosing this option. However, effect sizes will be smaller for income, gender, and education (T. R. Cohen et al., 2011; Koleva et al., 2012; McCright et al., 2016).

H1.3 Moral foundations and GASP variables will differentiate participants who choose not to pursue behaviors under current circumstances and GASP shame-withdrawal will have an opposite effect from other GASP variables: guilt-repair, negative behavior evaluation, and negative self-evaluation (T. R. Cohen et al., 2011; Kaiser & Shimoda, 1999; Mallett et al., 2013).

H1.4 Liberal political identity will be associated with greater odds of choosing "governments should spearhead ways to address this issue" than conservative political identity (Campbell & Kay, 2014; Krosnick et al., 2006; McCright & Dunlap, 2011; Stoutenborough et al., 2014).

Methodology

Study

The study involved a short, approximately 10-minute survey, approved by the university's institutional review board. Participants completed the survey through Amazon Mechanical Turk (mTurk) for a $1.25 compensation. The survey completion occurred February 5-8, 2020, prior to the first COVID-19 pandemic stay-at-home orders in the United States.

First, participants completed a standard consent form. Then, they sorted 18 PEBs pulled from an article by Truelove and Gillis (2018), which represented behaviors related to transportation, energy, food, and activism. The participants could sort the PEBs into four categories, indicating whether their household currently performs the behavior, plans to, could but does not, or could not.

Three follow-up questions, one with multiple answers and two open answer, asked participants to elaborate on responsibility for the behaviors they could adopt but have not. Following the behavior questions, participants completed four sets of questions on psychological and social measures: environmental attitudes, self-efficacy, purity and harm moral foundations, and guilt and shame proneness. The analysis examines correlations between these scales and attribution of responsibility by participants. Finally, participants completed demographic information that could be associated with PEB, including gender, age, race, education, income, political identity, and geographic location. See appendix F for survey questions.

In other similar mTurk surveys, approximately 19% failed to pass a manipulation check (Hoover et al., 2018). Thus, to reach a representative sample of people residing in the United States over the age of 18, the study team planned to contact 470 participants for an anticipated 385 responses. Of 531 surveys taken, 137 (26%) failed the attention check questions in the Moral Foundations Questionnaire, leaving 394 surveys in the analysis. Seven participants were removed because they chose libertarian as political identity. A libertarian political identity is associated with alternative moral foundations, which could affect results and was not ordinal on the conservative to liberal political scale (Iyer et al., 2012).

Methods

The survey included an initial question asking participants about their level of adoption of 18 PEBs. If the participants responded that they "could do but don't" do a behavior, then they received a question asking them to attribute responsibility for that behavior. For this study, the second question of responsibility was of interest. Since only participants who answered "could do but don't" received follow-ups, the frequency and distributions of answers varied by behavior. Some behaviors had high adoption levels, such as combining errands, so fewer participants were in the other adoption categories, such as "could do but don't." Others had

much more even distributions, such as driving a fuel-efficient vehicle, so more responses were available for analysis.

We ran Pearson chi-squared tests for goodness of fit to examine the distribution of responses for the PEB follow-up question. This question had six possible responses: two attributing responsibility to one's self, three attributing responsibility to other organizations, and an "other" category. Participants could select more than one. The null hypothesis of the chi-squared test is that the responses are uniformly distributed.

These distributional inconsistencies led to a multipronged approach. To determine the factors influential to responsibility attribution of PEBs, we ran Pearson chi-squared analyses, binomial regressions, and multinomial logistic regressions.

The binomial regressions ran separately for each behavior in each of the five defined response options for attribution of responsibility—not interested, not under current circumstances, business, non-profit, and government. These regressions collapsed the possible responses into yes and no categories. For example, if a participant chose the government to be responsible for fuel-efficient vehicles, then they would count as a "yes" in the binomial regression on the government attribution for that PEB. By collapsing responses this way, we could investigate behavior and responsibility specific predictors because with more responses in the "no" group, it only depended on having enough responses in the "yes" group, rather than adequate responses in all possible response groups. We only ran binomial regressions if both "yes" and "no" categories had at least 30 responses. Ordinal predictor variables were included in the models as numeric (Pasta, 2009).

The multinomial logistic regressions investigated responsibility attributions for each behavior. The responses were once again combined into categories, this time four. The first two were self-attributions of responsibility: "I choose not to pursue it and am not interested," and "I

choose not to pursue it under current circumstances." The three attributions to other organizations—businesses, non-profits, and government—were combined into a category attributing responsibility to another organization. The final category included responses that attributed responsibility to both one's self and another organization. A sixth "other" category was on the survey. Responses in the "other" category were relatively few, so they could not be analyzed as their own category. They also, by definition, do not fit with the others, so they were not included. However, if a participant responded affirmatively to more than one responsibility attribution, only the "other" attribution was not included in statistical analysis.

We used the stepAIC function in the MASS package in R to determine the model with the lowest Akaike's information criterion (AIC). Each model started with all thirteen predictor variables: four GASP, two moral foundations, self-efficacy, Brief Ecological Paradigm, and five demographic variables (Venables & Ripley, 2002). We ran multinomial logistic regressions if the self and other categories had at least 30 observations in the two categories for self-attribution and the category for attribution to an organization. Self-efficacy and Brief Ecological Paradigm were highly correlated. To avoid collinearity, if both were significant in a model, then it was run with the other variables and Brief Ecological Paradigm or self-efficacy separately. The model that had a lowest AIC was selected. The R^2 for attributing responsibility to a non-profit for donating to an environmental organization was less than .01, so it was excluded from reported results.

Results

First, the sample was compared to national demographics to check for differences. In some aspects the participants were representative of the country. Gender was roughly evenly distributed between male and female, and incomes of study participants were similar to the country with 29% of participants, reporting $60,000-79,999 in income, the most of any category.

The median income in the United States is $60,293 (*U.S. Census Bureau QuickFacts*, 2019).

In other ways, the sample diverged. The sample had a median age of 36, which is slightly younger than the median age in the United States of 38.5 (U.S. Census Bureau, 2019). The largest difference was that fewer people above the age of 60 participated than would be expected in a representative sample. The sample was also more liberal than the country with 50% identifying as liberal versus 26% in the country. Likewise, moderates and conservatives were underrepresented, though evenly split with 23% and 25%, respectively. In the United States, they are 35% of the population each (Gallup Inc., 2019).

White participants were over-represented at 74%, as compared to 60% in the country. The "other" category, which also included participants with more than one identification, was also overrepresented in the sample with 8% of participants versus 3% nationally. The most notable difference was in participants who identified as Hispanic/Latino, 4% versus 18% nationally, and participants who identified as black or African American, 8% versus 12% nationally. Finally, participants were more highly educated than the American population above the age of 25. Fewer participants reported education including a high school diploma or less 11% versus 38% nationally. More participants had a bachelor's degree than would be expected in a representative sample, 45% versus 20% nationally (U.S. Census Bureau, 2019).

The initial question asked participants to choose the level of behavior adoption most closely reflecting their household. The groups significantly differed with 41% already adopting the behavior ($M = 7.40$, 95% CI = 7.05, 7.74), 12% planning to adopt it ($M = 2.25$, 95% CI = 1.98, 2.51), and 16% could not adopt it ($M = 2.86$, 95% CI = 2.57, 3.15). This study investigated the third group, participants who identified "could do but don't" do various PEBs. These participants made up 31% of the behavior adoption responses over 18 behaviors, $X^2 (N = 7092, 3) = 1514.9$, $p < .001$. Participants identified an average of 5.50, 95% CI [5.12, 5.87] behaviors that they "could do

but don't."

Next, the most prominent pattern in the data was that the participants who said they "could do but don't" perform a behavior largely attributed responsibility for the associated PEBs to themselves, either in the not "under current circumstances" or "not interested" categories. Among participants receiving the follow-up questions, 76% attributed it to themselves only. Another notable trend was that the majority of participants attributed responsibility to themselves or to other organizations but not both. While 16% chose another organization to spearhead efforts on the PEB, only 8% chose both themselves and others as responsible, X^2 (2, N=2165) = 1516.1, p-value < .001.

Eleven of the PEBs had at least five observations in all five defined groups of responsibility, which allowed a Pearson chi-squared test of goodness of fit. Differences between behaviors were also significant between six attributions of responsibility—not interested, not in current circumstances, business, non-profit, government, other— X^2 (50, N=1986)= 159.18, p-value < .001. Specifically, fewer participants were not interested in fuel efficient vehicles than would be in a uniform distribution. Fewer participants reported that they were not donating to an environmental organization or petitioning under current circumstances, and fewer participants attributed responsibility to non-profits for water heater temperature or any other organization for a choosing a vegetarian meal over beef.

More participants than would be expected in a uniform distribution responded that they were not driving a fuel-efficient vehicle under current circumstances. Significantly more were not interested in a vegetarian meal over beef and not choosing pasture-raised eggs or meat under current circumstances. In activism behaviors, more participants thought businesses and non-

profits should spearhead efforts in donating to environmental organizations, and more responded that non-profits should spearhead protest efforts. See Figure 14 for differences

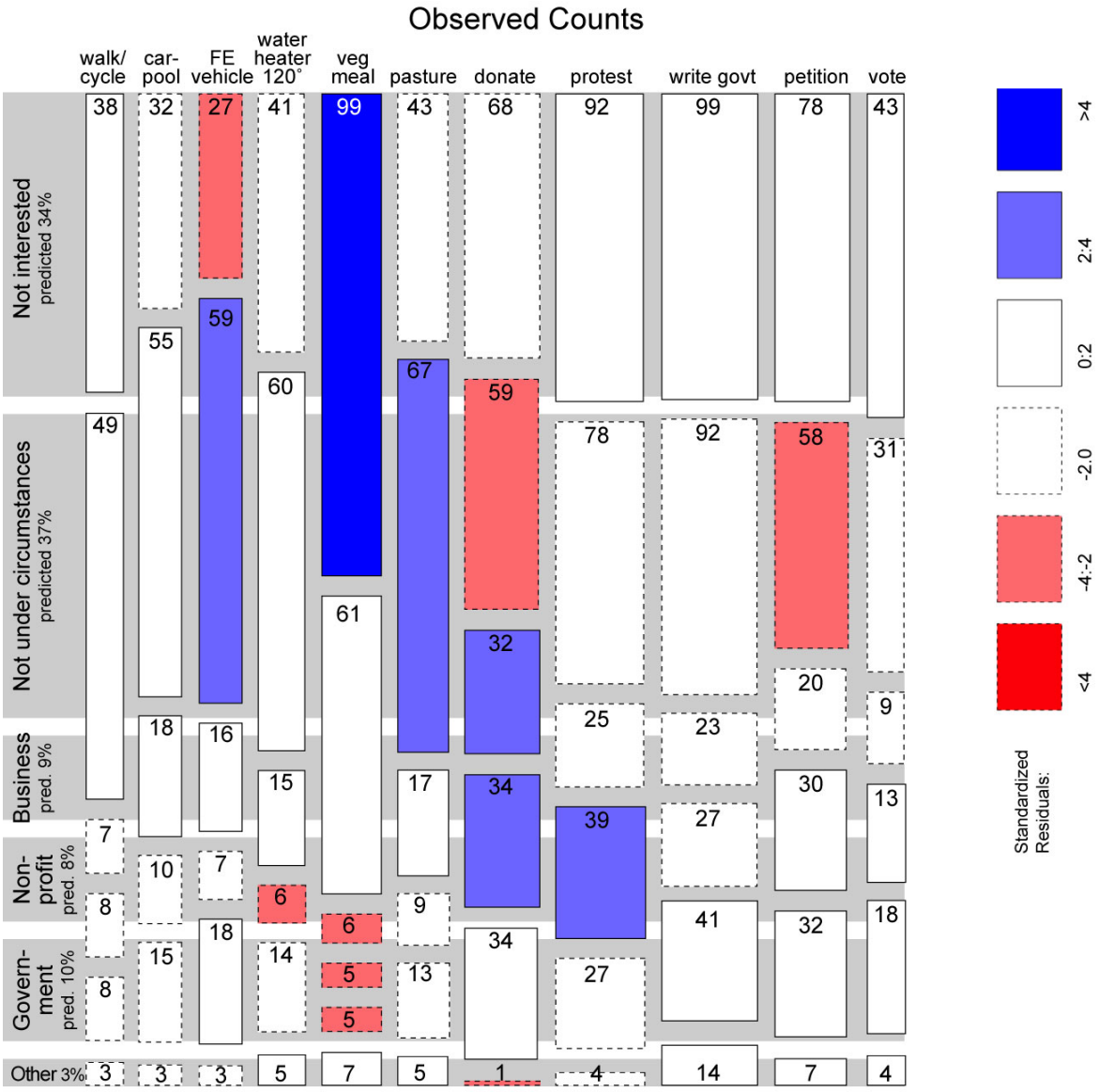


Figure 24: Mosaic Plot of Six Attributions of Responsibility

The plot represents results from a Pearson chi-squared test on the frequencies of participants' responsibility attributions for each behavior, compared with the expected response (gray boxes). The width of the columns represents the total number of observations in the column. The number at the top of each box represents the number of participants who chose that responsibility attribution for the PEB. Red cells indicate fewer responses than would be expected, and blue cells indicate more responses than would be expected.

between specific groups.

To explore the variables influential to attributing responsibility, binomial regressions

	Reason	Variable Name	BEP	SE	MFQ harm	MFQ purity	GASP NBE	GASP NSE	GASP shame withdraw	GASP guilt repair	Gender	Age	Education	Income	Political ID	MF R2
I choose not to pursue it and am not interested.	1	Walk/Cycle		0.26 **		0.63 *				1.49 ns	0.38 .					0.18
	1	Carpool		0.24 **								0.96 .	0.70 .			0.17
	1	Line Dry		0.53 *	0.71 ns				0.69 *		0.40 *					0.15
	1	Water 120		0.43 **												0.07
	1	Veg Day		0.24 **						1.77 **			0.77 .			0.18
	1	Veg Meal		0.35 **						1.88 **			0.78 .	0.85 ns		0.14
	1	Pasture		0.40 **	0.57 *			0.78 ns				0.97 ns				0.16
	1	Donate		0.33 **		1.42 *										0.14
	1	Protest		0.27 **		1.38 *	0.70 *			1.72 **	1.72 .					0.16
	1	Write Gov't		0.29 **		1.27 *		0.82 ns		1.38 .		0.98 ns				0.14
	1	Petition		0.27 **		1.21 ns	0.74 .			1.51 *						0.15
	1	Vote		0.24 **	0.55 .			0.68 *								0.21
I choose not to pursue it under current circumstances	2	Walk/Cycle		1.88 .		2.22 **							0.64 *	1.26 ns	1.57 *	0.17
	2	Carpool		2.05 *	0.62 ns			1.44 .				1.03 .				0.07
	2	FE vehicle			1.63 .			1.40 .							0.79 ns	0.07
	2	Line Dry	2.08 **				1.21 ns		1.42 *		2.34 *					0.14
	2	Weatherstrip			1.86 .	0.56 *		1.49 .		0.56 *					0.71 ns	0.09
	2	EEwater		3.24 *	0.47 .			1.61 .		0.55 .	3.25 *	1.06 *				0.14
	2	Water 120		1.51 ns			1.37 ns			0.67 .	2.36 *					0.08
	2	Veg Day		5.34 **	0.60 .		1.55 *			0.57 *			1.28 .		0.74 ns	0.18
	2	Veg Meal		2.38 **		1.27 .	1.24 ns			0.64 *				1.26 *		0.10
	2	Pasture	1.97 **			1.49 *	1.68 **			0.72 ns						0.12
	2	Donate		1.56 ns				1.25 ns				1.02 ns			1.47 *	0.08
	2	Protest		2.61 **		0.76 *		1.43 *		0.71 .		1.03 *	0.86 ns			0.11
	2	Write Gov't		2.72 **		0.81 .	0.71 *	1.58 **		0.84 ns		1.02 ns				0.11
	2	Petition		1.73 *		0.77 *		1.50 *		0.74 ns		1.02 ns				0.07
	2	Vote	1.55 ns		1.63 ns					0.67 .					0.68 .	0.08
An organization should spearhead it.	3	Donate										0.93 **		1.24 ns		0.12
	4	Protest	1.50 ns				1.63 *			0.60 *		0.94 **	0.76 .			0.11
	4	Petition						1.57 .		0.63 .		0.95 *				0.08
	5	Donate	2.84 **													0.08
	5	Write Gov't		1.73 .		1.60 **						0.95 *			1.66 *	0.12
	5	Petition		3.70 **								0.97 .				0.12

· p < 0.10 * p < 0.05 ** p < 0.01

Table 7: Binomial Regression for Attribution of Responsibility

Results are included from a binomial regression with all responses attributing responsibility to the identified column (1) run against a baseline of any other attribution of responsibility (0). Regressions were run on all PEBs with distributions adequate for stable models (at least 30 observations for participants choosing the response option and not choosing it). Reason "3" represents businesses. Reason "4" represents non-profits, and reason"5" represents government. Red indicates an odds ratio less than one, and green indicates above one.

were run on each PEB for each responsibility condition (Table 7). Given participants largely assumed responsibility themselves, the binomial regression analyses on the attribution of responsibility were only possible on a sub-set of the behaviors that had at least 30 observations in each attribution category. Fifteen of the 18 PEB variables had enough observations for a stable model for at least one of the attribution options. Pro-environmental behavior response variables for combining errands, maintaining tire pressure, and using energy efficient lighting had no viable models for predicting participants' attribution of responsibility.

The category of PEBs with the most viable behaviors was activism—donating, signing a petition, protesting, writing to government, and voting. This was a surprising result because it means that in some cases participants attributed the responsibility to spearhead these activism behaviors not only to businesses and non-profits but also to government.

Although the predictor variables in each regression were different, higher self-efficacy was associated with lower likelihood of choosing "I choose not to pursue it and am not interested," for all of the models. Conversely, higher self-efficacy was associated with greater odds of responding not "under current circumstances" or that another organization should spearhead efforts in the models in which it was significant.

The effect reversals between models for PEBs with the responses for "not interested" and not " under current circumstances" extend to other variables as well. When purity and guilt-repair were significant in models for both responses, the direction of the effect switched. In fact, any variable that was significant in models for participants who are not interested and those not pursuing a behavior under current circumstances switched signs between the two.

When negative self-evaluation was significant, it was mostly in the models for "I choose not to pursue it under current circumstances." As it increased, participants had higher odds of selecting they were not choosing PEBs "under current circumstances." However, few other

variables were as consistent between "not interested" and "not under current circumstances" responsibility attributions as self-efficacy, negative self-evaluation, and guilt-repair.

To explore the relationship between participants who are not interested and not pursuing a PEB under their current circumstances, Welch's t-tests were run examine the difference in the mean in the number of PEBs adopted between participants who responded "not interested" and not "under current circumstances." They were run on each PEB which had a binomial regression for both self-attribution response. For seven of the PEBs, the results indicate

Variable	t statistic	Mean "Not interested"	Mean "Not under circumstances"	Confidence Interval	p-value
Walk/cycle	t (74) = -2.88	4.95	6.52	-2.67, -0.49	0.01 *
Carpool	t (65) = -3.42	5.31	7.63	-3.68, -0.97	0.00 **
Linedry	t (126) = -2.40	6.30	7.49	-2.18, -0.21	0.02 *
Water 120°	T (81) = -0.83	5.54	6.02	-1.63, 0.67	0.41
Vegetarian day	t (83) = -0.76	5.87	6.28	1.50, 0.67	0.45
Vegetarian meal	t (91) = -0.79	6.03	6.43	-1.41, 0.61	0.43
Pasture-raised	t (76) = -1.76	5.00	5.92	-1.98, 0.12	0.08 .
Donate	t (96) = -0.75	6.31	6.74	-1.59, 0.72	0.46
Protest	t (138) = -2.73	6.60	7.88	-2.20, -0.35	0.01 *
Write government	t (158) = -3.20	6.33	7.74	-2.28, -0.54	0.00 **
Petition	t (105) = -0.56	6.17	6.46	-1.31, 0.73	0.58
Vote	t (63) = 1.33	5.32	4.63	-0.35, 1.72	0.19

· p < 0.10 * p < 0.05 ** p < 0.01

Table 8: T-Test of Adopted Behaviors Between Self-Attribution Groups
T-tests compared the means of the total number of PEBs adopted between participants who chose "not interested" (1) and "not under circumstances" (2) in response to each PEB.

a failure to reject the null hypothesis, meaning the means could be the same. For the other five, the mean number of PEBs was significantly higher for participants who chose "not under current circumstances." See Table 8 for t-test results.

Due to low numbers of observations, it was only possible to run multinomial regressions on a few behaviors with the attribution of responses to organizations. The models were all for activism PEBs, and the predictor variables were inconsistent between behaviors. Self-efficacy was significant in all of the models for at least one of the attribution categories. In each case, the odds were greater of being in a category other than "not interested" as self-efficacy increased.

Age and guilt-repair were in three of the four models. Higher age was associated with greater odds of choosing an option attribution other than "not interested," whereas higher guilt-repair was associated with lower odds of choosing "not under circumstances or another organization and higher odds of choosing both.

Participants with higher purity moral foundations were less likely to choose "not under current circumstances" as compared with "not interested." Higher negative self-evaluation was associated with greater odds of choosing an attribution to self and another organization as compared with "not interested" alone. See Table 9 for full models.

Discussion

The first hypothesis (H1.1) was that many participants who "could do but don't" do a PEB would attribute the responsibility to another organization. However, the vast majority attributed responsibility to themselves. This result could be related to the culture of the United States. Individual messaging is common. For example, energy labeling encourages individuals to purchase efficient appliances, and social comparisons encourage individuals to use less energy than their neighbors (Nisa et al., 2019). The familiarity of these individual appeals may

contribute to individuals' beliefs about who is responsible.

Additionally, news media in the United States tends to focus on particular events and accountabilities for specific actions, known as episodic coverage. Episodic coverage could distract from the broader picture of how societal or political factors contribute (Aalberg & Curran, 2012). Research indicates that it may lead to greater attribution of responsibility to a specific person, while broader thematic coverage may lead to greater attribution to society (Hart, 2011; Iyengar, 1996).

These news coverage frames may be well suited for the individualistic culture of

		Predictor Variable	Comparing not interested (1) to not under circumstances (2) *Coefficient ± Std. Error*	Comparing not interested (1) to other (3) *Coefficient ± Std. Error*	Comparing not interested (1) to both (4) *Coefficient ± Std. Error*
Donate	MFR²: 0.06 CS R²: 0.16	Self-efficacy	2.24 (1.21, 4.14) **	3.62 (1.85, 7.09) **	2.38 (1.10, 5.14) *
		Purity moral foundation	0.71 (0.51, 0.99) *	0.86 (0.61, 1.20) ns	1.14 (0.75, 1.72) ns
Protest	McFadden R²: 0.11 Cox-Snell R²: 0.25	Age	1.03 (1.00, 1.06) *	0.98 (0.94, 1.02) ns	0.96 (0.90, 1.01) ns
		Self-efficacy	4.13 (2.24, 7.61) **	3.71 (1.71, 8.06) **	2.30 (0.92, 5.77) .
		Guilt-repair	0.62 (0.40, 0.96) *	0.59 (0.37, 0.94) *	0.55 (0.28, 1.09) .
		Negative self-evaluation	1.37 (0.95, 1.97) .	1.05 (0.73, 1.51) ns	2.26 (1.08, 4.71) *
Write government	McFadden R²: 0.13 Cox-Snell R²: 0.28	Age	1.03 (0.10, 1.06) .	0.981 (0.94, 1.02) ns	0.96 (0.91, 1.01) .
		Political identity	0.878 (0.06, 1.29) ns	1.18 (0.74, 1.87) ns	2.35 (1.40, 3.94) **
		Self-efficacy	3.78 (2.04, 7.01) **	2.48 (1.16, 5.29) *	1.94 (0.89, 4.19) .
		Purity moral foundation	0.677 (0.49, 0.94) *	1.27 (0.83, 1.92) ns	1.75 (1.11, 2.76) *
		Guilt-repair	0.817 (0.58, 1.16) ns	0.65 (0.43, 0.99) *	1.11 (0.67, 1.85) ns
Petition	McFadden R²: 0.13 Cox-Snell R²: 0.27	Age	1.02 (0.98, 1.05) ns	0/98 (0.94, 1.03) ns	0.98 (0.92, 1.05) ns
		Self-efficacy	3.35 (1.80, 6.25) **	6.43 (2.79, 14.8) **	1.52 (0.57, 4.07) ns
		Guilt-repair	0.64 (0.38, 1.09) .	0.54 (0.31, 0.93) *	0.76 (0.34, 1.79) ns
		Negative self-evaluation	1.48 (0.92, 2.37) ns	1.09 (0.68, 1.77) ns	3.02 (1.23, 7.40) *
		Negative behavior-evaluation	1.02 (0.62, 1.68) ns	1.28 (0.74, 2.22) ns	0.47 (0.23, 0.99) *

ns = not significant · p < 0.10 * p < 0.05 ** p < 0.01

Table 9 Multinomial Regression for the Attribution of Responsibility:
Models for predicting responsibility attribution for activism PEBs with a four-level response multinomial logistic regression: "not interested," not under current circumstances." "other," and "both." Red indicates a negative relationship, and green indicates positive.

Americans, especially when broader societal action can be viewed as drastic or politically driven. In another study, participants with higher trust in government found policy solutions to environmental issues more acceptable (Ejelöv & Nilsson, 2020). These would have possibly shown up in this study as governmental responsibility. However, only 17% of Americans believe that they can trust the government to always or mostly to do what is right (Pew Research Center, 2019; Rainie et al., 2019). Thus, the historic low in American trust in government could also be a contributor to the preference for individual responsibility.

Another distinguishable pattern in the results is that participants who attributed responsibility to themselves differed from each other depending on whether they responded "not interested" or "not under current circumstances." The most consistent predictor in the models was self-efficacy with opposite effects between these responses. Lower self-efficacy was associated with "not interested" responses, whereas higher self-efficacy was associated with not "under current circumstances." Self-efficacy is a common predictor in behavior models, such as Theory of Planned Behavior. Thus, self-efficacy's importance in this study's models is consistent with expectations (H1.2) (Ajzen, 1991).

It appears that the effect of self-efficacy is related to whether participants leave open the possibility of themselves or other organizations pursuing the behavior. High self-efficacy is usually associated with greater adoption of PEBs. In chapter three, high self-efficacy is correlated with currently doing behaviors. In the current study, all participants are non-adopters, so this pattern indicates that there are differences in the way in which participants attribute responsibility to themselves even when they are not performing the behavior. However, self-efficacy appears to be less consistently influential in predicting responsibility attributions to other organizations.

In fact, participants who attribute responsibility to another organization were so rare that

they were difficult to study. However, from the limited data available, they resembled participants who responded not "under current circumstances" with regards to self-efficacy and guilt-repair. To some extent, these results support the data from other research. Youth surveys in the United States in which participants' views of personal responsibility reflect their views of government responsibility (Wray-Lake et al., 2010). They tend to increase or decrease together.

The third hypothesis anticipated that moral foundations and GASP variables would differentiate participants who choose not to pursue behaviors under current circumstances from those who were "not interested." This hypothesis was partially supported. Moral foundations and GASP variables were significant in several models. For guilt-repair, in particular, the direction of the effect changed between the two self-attribution categories, differentiating them. Whereas guilt-repair was associated with greater odds of currently doing a behavior in chapter three, here it was associated with greater odds of responding "not interested." Negative self-evaluation was not significant in any of the models for adoption level in chapter three, but it was significant between attributions of responsibility.

However, most of the variables had inconsistent effects between behaviors. Shame withdrawal was only significant in two models and affected them in the same direction as other GASP variables, which contradicts hypothesis 1.3. Shame expressed through negative self-evaluation, on the other hand, tended to have the opposite effect as other GASP variables when they were in the models together. This effect was unanticipated. Additional research should explore the roles of shame and guilt in attributions of responsibility to understand these relationships.

Political identity also did not play an important role in differentiating the responsibility attributions. It was only significant in two of the binomial regressions and one of the multinomial regressions. Yet so few participants responded that the government should spearhead efforts, it is

not possible to draw conclusions (H1.4). Additional research with a larger sample would be required to investigate the effect of political identity on responsibility attribution to organizations.

Although we did not formally investigate the reasons participants chose to attribute responsibility for each behavior to themselves or another organization, participants had the option to write an explanation for their choice. A few themes emerged.

Cost in time and money was a common theme among participants who chose to write comments. One participant summarized, "Of the behaviors listed under 'not interested,' I simply have no desire to do these things and I have no plans to change that. Regarding the behaviors listed under 'not in current circumstances,' I have limitations with housing and money that prevent me from doing these things. Otherwise, I'd adapt [sic] these behaviors."

Others echoed similar sentiments. "I would love to be able to choose meat or eggs from open-pasture raised animals but this kind of produce tends to be over priced and on my budget I could not afford it," wrote another participant.

Some also felt like they lacked the necessary information to adopt the behaviors. Still others lacked interest entirely. "I simply have no interesting [sic] in eating a vegetarian diet, protesting, writing to a government official, or anything like that because I do not think that's particularly useful in terms of being beneficial to the environment," said one participant. Some expressed that activism PEBs felt useless. "I think it is a waste to write the govt officials. They barely can agree to talk among themselves let alone care what I think," wrote someone else.

Participants also weighed in on why they chose or did not choose specific organizations to spearhead PEBs. For example, one participant felt government regulation would be more effective than individual action, "Governments can mandate that all water heaters be energy efficient, it's far more effective than human action."

Others relied on the resources of businesses to enact effective change. “I think in some cases, business are better equipped financially to get the word out about various issues. Individuals like myself are very limited in what they can do and do not have the same scope of coverage that a business would,” wrote a participant. Still others depended on the government to hold businesses accountable, “My carbon footprint is almost zero while businesses and the wealthy create the vast majority of environmental issues we face today so they should be responsible. It is up to our government to hold them accountable.”

Some simply expressed that coordinated action is more effective than individuals alone. Non-profits were one organization that participants saw with potential for spearheading those efforts. One summarized it, “I think that non-profits are better able to organize petitions about environment things, and to get people and businesses to make changes.”

Limitations

Conducting a study with a novel design led to several discoveries that could improve further research. For example, written explanations help with understanding why self-efficacy was important and how other information, such as trust in organizations, would be useful additions to models. Additional study into the reasons for specific attributions of responsibility would assist with interpreting the results of the models.

Without precedent for this study design, other limitations and improvements were apparent. For instance, we did not know what the distribution of responses would be. Therefore, many categories had few observations, preventing analysis. Additionally, none of the models had a McFadden R^2 value above 0.20, meaning that other meaningful factors or contextual information may be missing from these models. However, it is also possible that these effect sizes reflect that the study could be improved with a more detailed and targeted format. More refined

investigation of responsibility attributions of PEBs and climate action are needed to validate these results and explore the relationships of variables more extensively.

Future research could improve this approach by asking follow-up questions not only to people who "could do but don't" do behaviors but also asking people who "currently do," "planning to," or "could not do" behaviors who they thought should be responsible. We did not ask these questions for the sake of brevity in the survey, but it would allow the comparison of perceptions of people in different levels of adoption.

Additionally, the behaviors could be modified. Some behaviors were so universally adopted already, that few people said they do not perform them. Some transportation behaviors in the survey have already drastically changed for many people because of COVID-19, as more people work from home or use active transportation to avoid crowds on buses or trains. Of course, the surveyed behaviors should still be impactful, but they could be selected for policy relevance and level of adoption as well.

Furthermore, the instrument for self-efficacy included questions directly related to climate change in this study, asking whether participants believe their actions influence climate change and influence others to act on climate change. The measure of self-efficacy was highly correlated with Brief Ecological Paradigm, intended to measure environmental attitudes. Thus, it is possible that one reason self-efficacy was so influential and environmental attitudes were not is because the self-efficacy measure was representing attitudes as well. Ensuring these instruments are measuring separate variables is important to future studies.

Another modification that could improve the quality of results would be to adjust the wording of the follow-up questions. The current study let people choose that another organization should spearhead the issue. However, not every pairing makes immediate sense, such as attributing carpooling or eating vegetarian to another organization. Indeed, other

organizations have spearheaded efforts on these issues with ride matching services to encourage carpooling or the development of vegetarian meat alternatives. Yet, without specifying any particular initiatives, it could also leave people with images of the government designating them a carpool buddy or a grocery store removing meat from the shelves. In the current format, we are measuring any initiative that participants might imagine.

Finally, this study was conducted on mTurk. The online format allowed access to participants across the country. While mTurk allows access to a wide audience, it is still limited. It excludes participants who do not have Internet access. As discussed in the results section, the sample does not fully represent the demographics of the United States. The sample overrepresents white, liberal, educated, and young people. With some groups underrepresented, this study is not representative of all the United States, and it is inadequate to draw conclusions about specific groups. Some variable may be missing from models that would be significant if the full breadth of society were represented. However, research has indicated that mTurk is a valid tool for psychological research that uses political identity (Clifford et al., 2015). Additional research could be more inclusive by recruiting participants through an alternative method or offering the survey in other languages.

Conclusion and Policy Implications

Participants who chose "could do but don't" were the focus of this study. Many participants had already adopted a few PEBs, but many behaviors were still not appealing, convenient, or cost-effective. Yet, according to these results, the majority of individuals perceive the responsibility as primarily theirs when they could do a behavior but are not. A minority of participants thought other organizations should spearhead the efforts or that a combination of individual responsibility and organizational responsibility would be appropriate. Most

participants attributed responsibility to themselves alone and did not indicate that organizations should spearhead efforts.

However, this study only includes participants who responded that they "could do but don't" perform a behavior. They are not a majority of the original sample. Even among participants who chose "could do but don't," personal responsibility to not perform the behavior "under current circumstances" was the most common attribution of responsibility, which indicates an openness to change.

These results could inform policy development. Attribution of responsibility contributes to the solutions people will support (Chang et al., 2016; S.-H. Kim, 2015; Yang et al., 2015). That participants indicated under different circumstances their behaviors would be different is an opportunity. Interventions that reduce barriers to PEBs could benefit participants whose circumstances have led them not to pursue environmental options.

Interventions could include structural changes that provide better access to programs or infrastructure, incentives, or subsidies. Some behaviors have already been successfully encouraged. Energy efficient lighting, for example, has benefited from advancements in technology and changes in policy (Popovich, 2019). In this study, it was already widely in practice. Such a small number of participants chose "could do but don't" for energy efficient lighting that analysis was not possible. In some cases, such as energy efficient lighting, participants who were not interested could also be the late majority and laggards in terms of adoption (Rogers, 2010). Other behaviors with lower penetration, such as the activism behaviors in this study, could be more fruitful opportunities of impactful change.

Two behaviors that had an especially large group of people not doing them "under current circumstances" were driving a fuel-efficient vehicle and choosing pasture-raised eggs or meat. Programs reducing barriers to these particular behaviors could yield voluntary behavior

changes more easily than others. In the case of these behaviors, the results in chapter three and anecdotal evidence from participants' comments indicate that cost is a barrier to both fuel-efficient vehicles and pasture-raised meat and eggs. Thus, exploring the financial incentives and disincentives for these options and alternatives to these options would be a place to start in changing behavior. Examples include, the agricultural subsidy structure or tax credits for energy efficient homes, commercial buildings, and renewable energy.

Other behaviors may require different types of interventions. For example, a disproportionate number of people responded that they were not interested in choosing a vegetarian meal over beef. Many participants are not ready to voluntarily adopt this behavior yet. However, meat substitutes are one possibility for enjoying a meal that does not feel vegetarian. Cultural shifts in norms about a healthy portion sizes and expectations about meat at meals would be another possibility. Unlike fuel-efficient vehicles, the results indicate that the cost of plant-based meals is not the primary barrier for most people in this study. Thus, other types of interventions may be more appropriate. Likewise, interventions for each PEB would need to reflect the attributions of responsibilities of individuals and the variables that are influential to that decision.

Results also indicate that self-efficacy, negative self-evaluation, and guilt-repair differentiate participants who are "not interested" and not pursuing a behavior "under current circumstances." Although less research has focused on negative self-evaluation and guilt-repair in attributions of responsibility for environmental behavior, research supports that training in self-efficacy specific to the desired behavior could have a lasting impact on behavior (Fitzgerald & Schutte, 2010; Geiger et al., 2017; Nichols et al., 2009; Schutte & Bhullar, 2017). When self-efficacy is a barrier, targeting it directly may be beneficial.

In conclusion, this study indicates that the majority of participants who could perform a

behavior but do not and are not planning to start believed that they were responsible. At first, it may sound like nothing further will happen if the choice is left to them. However, analysis revealed that even within this group of non-adopters, many reported that they could change their behavior under other circumstances. Additionally, some participants identified organizations that could to spearhead efforts. A minority are not interested. While it is possible that participants who are not interested could still benefit from organized initiatives, the results suggest that addressing barriers for people who are limited by circumstances and pursuing action through organizations could serve many people who have not adopted the PEBs.

CHAPTER 5

SUMMARY & CONCLUSIONS

This dissertation explored factors influential in the adoption of pro-environmental behaviors. The first study tested the effectiveness of moral foundations-based feedback in conjunction with a carbon calculator. It contributes to the literature by reporting on these interventions in an applied setting and comparing the effects on self-reported and objective measures of behavior over time.

The second study investigated the socio-demographic and psychological predictors of specific pro-environmental behaviors (PEBs). It adds to a body of knowledge, recognizing that PEBs are heterogeneous and therefore some predictors may be as well. Understanding these differences provides the opportunity to tailor interventions to specific behaviors.

The final study investigated the same predictors in search of greater understanding of who participants would identify as responsible if they, as individuals, were not pursuing a behavior. The emissions associated with human societies exceed planetary boundaries; however, environmental action is a multidimensional problem with solutions that individuals and organizations can implement (Rockström et al., 2009). Understanding who individuals perceive as responsible could be another tool in developing strategies for addressing environmental issues.

Moral Foundations and Behavior

A carbon calculator combined with an intervention aligning with the harm moral foundation was associated with a small increase of reported behaviors related to electricity and transportation for participants with high moral foundations scores. However, these effects were inconsistent between behavior types and between participants with low and high moral foundations. Self-reported changes were slight, and they were imperceptible in electricity usage among participants. Utility readings

provided no evidence that the intervention reduced electricity use or carbon emissions. These results suggest that future studies should use objective measures of behavior, consumption, and emissions when possible because self-reported behavior is not necessarily correlated with actual behavior or impact. Additionally, the results suggest that the strength of people's moral foundations is important to the resonance of a message with an audience, possibly regardless of whether they are harm or purity moral foundations.

Predictors of Specific Pro-environmental Behaviors

Given the marginal effects of the first study's interventions on PEBs, the second study explored the predictors of specific behaviors more in-depth. The study also explored the role of moral foundations and guilt and shame proneness among participants who currently perform a behavior and among three categories of participants who did not. It contributes a unique perspective on not only the predictors in adopting behaviors but also not adopting them. While participants had widely adopted some behaviors, such as installing energy efficient lights, many also reported that they could not adopt others, such as carpooling or line drying laundry. Participants responding that they were planning to perform a behavior were relatively few as compared with other options, indicating that few people are in the transition to a behavior at a given time.

Self-efficacy was the most consistent predictor. However, age and political identity were influential as well. Guilt-repair and shame-withdrawal had not been studied in this context before, but they seemed to be significant in the difference between planning to perform a behavior and doing it. Higher levels of guilt-repair were associated with greater likelihood of currently doing the behavior, while shame-withdrawal was associated with greater likelihood of planning to do a behavior or reporting that they could not do it. Other predictors were less consistent or only significant for a few behaviors.

Predictors of Responsibility Attribution

When individuals could do a PEB but do not, the third study probes to whom individuals attribute that responsibility. Most participants attributed responsibility to themselves alone. However, responses indicated that participants who were not interested in PEBs and participants who were not performing the PEB under current circumstances differ. The second group had higher self-efficacy, which was also a predictor of adopting behaviors. Guilt-repair and negative self-evaluation GASP variables also differentiated the groups. Guilt-repair was associated with higher odds of responding a person was responsible but not interested, whereas negative self-evaluation was associated with higher odds of choosing a person was responsible but not pursuing it under current circumstance.

The selection of not "under current circumstances" indicates that different circumstances might provide these individuals with an opportunity to change their behavior. Changes in circumstances could include changes in policy, markets, or opportunities. For example, fuel-efficiency standards, accessibility of services, public transit, car-sharing services, and ride-sharing services could all change the circumstances for transportation PEBs. Identifying prevalent barriers could inform solutions that would meaningfully change the circumstances that inhibit or facilitate PEBs.

Recommendations

First, this research supports the strong importance of self-efficacy in models to predict both the adoption and non-adoption of PEB as well as the attribution of responsibility, it is possible that increasing self-efficacy or perceived behavioral control could increase people's engagement in PEB. Participants in this study who are not interested in adopting a PEB are a minority. Although this cross-sectional study cannot determine causation, other research has demonstrated that an intervention targeted at self-efficacy can have a positive effect on behavior (Fitzgerald & Schutte, 2010; Geiger et al., 2017; Nichols et al., 2009; Schutte & Bhullar, 2017). For all the criticism of the information deficit model, the study also suggests that

targeted education is yet another way to overcome a behavior-specific barrier.

Among non-adopters in study three, many have indicated that under different circumstances PEBs could be more possible for them. Not "under current circumstances" was the most common attribution of responsibility among participants who "could do but don't" perform PEBs. In the comments, some mentioned cost of the behavior, the availability of opportunities, or the perception that their actions were not effective as barriers limited their actions. Addressing self-efficacy for overcoming specific perceived behaviors may have a role alongside structural and systematic changes. As previous research has suggested, practitioners and policymakers should tailor interventions these to specific barriers and behaviors (McKenzie-Mohr, 2013).

Second, guilt-repair and shame-withdrawal emerged as playing a role in the difference between planning to do a PEB and doing it. The results in chapter two found a small effect of moral messaging on behavior, and other research has supported that emotions influence the acceptability of policy. For example, hope and worry predict support for climate policy more strongly than sociodemographic and cultural factors (Ejelöv & Nilsson, 2020). Practitioners and policymakers can improve the reception of their messaging by remaining cognizant how these messages resonate on moral and emotional levels because moral messaging affects behavior and policy support (Adger et al., 2017; Dickinson et al., 2016; Feinberg & Willer, 2013; Kidwell et al., 2013; Koleva et al., 2012; Severson & Coleman, 2015; Wolsko et al., 2016).

While communicating a message in a way that an audience can receive and understand is important, choosing impactful behaviors to communicate is just as important. An individual or organization with limited resources usually desires initiatives with high impact and a high likelihood of success. The results in chapter two support designing an intervention proportional to the desired change (Osbaldiston & Schott, 2012). If the intended behavior change is a reduction in utility use over the course of several weeks, it may require a more intensive intervention than information provided by a carbon

calculator and moral messaging. Matching the size of the intervention to the requested change is essential to success.

Additionally, studies two and three suggest barriers and opportunities for behavior changes as well as challenges to implementing them. Participants in these studies had often already adopted at least a few behaviors already. The results indicated that self-efficacy was an influential factor, but income barriers, for example, were important to specific behaviors. Each behavior had its own set of influential variables that contributed to decisions participants had made about their adoption of that behavior and attributing responsibility for it. Drawing on these variables for specific behaviors could help with developing a targeted and effective initiative.

Furthermore, the majority of participants, who could do a behavior but who were not, thought the responsibility was theirs. Although most did not directly attribute responsibility to another organization, many indicated that if circumstances changed, they might too. Organizations frequently change circumstances by developing business ventures that fill a need. For example, bike share programs reduced barriers to low carbon transportation by making bicycles more accessible for quick trips and the last mile from transportation hubs. Meat alternatives allow people to enjoy their favorite meals without the carbon impact of raising livestock. Non-profits cultivate community gardens for greater accessibility of plant-based meals, and others develop programs that make adopting efficiency and renewable energy easier. Finally, policies affect population densities, efficiency standards, regulations that increase or decrease access to technology and services, and many decisions individuals make. The circumstances and barriers affecting a specific behavior could be the key to identifying opportunities for change.

Future Research

Further study is still needed to understand the effects of moral and emotional messages on PEBs. The first study indicates that the effects may vary between behaviors and the strength of the audience's

moral foundations. However, previous research found greater effects from messages that were congruent to the audience's moral foundations. Exploring these relationships further could improve the ability of people communicating climate change to relate information to groups by speaking in language that fits their values. Additional research on the relationship between values and collective action, attribution of responsibility, and support for policy could also assist with communicating issues in ways different groups understand.

Since moral messaging had greater impact in low-level behaviors in previous work, exploration of the relationship between the intensity of the intervention to the desired level of impact is worthwhile. Behaviors like donating a portion of the compensation for participating in a study or using curbside recycling have been responsive to moral foundations interventions (Kidwell et al., 2013; Wolsko et al., 2016). However, interventions in the first study did not influence electricity use over the course of weeks. Research is already exploring the perceived difficulty, cost, and effectiveness of PEBs (Truelove & Gillis, 2018). Understanding the scale of interventions in relation to these aspects could ensure that interventions are proportional to the desired outcome.

Additionally, the second and third studies occurred shortly before the wide spread of the COVID-19 pandemic and the growing support of the Black Lives Matter movement in the United States. Prior to these movements, the majority of participants assumed responsibility for behaviors that they could do but were not. Exploring what if any role Americans view for organizations merits study on its own. However, many PEBs have already changed in the past few months based on decisions made at every level from voluntary individual measures to business and governmental decisions. Perspectives on activist behaviors have also likely shifted. Exploring changes in these perceptions before and after the pandemic and expending a more concerted effort to survey participants representing the diverse make-up of the country would help with conceptualizing a bridge from individual actions to the role of collective actions and organizations. These relationships also depend on cultural factors that have

changed across the world over the course of months. Although Americans attribute responsibility to themselves, answers are likely to vary by culture, which would be another opportunity for research.

Lastly, a standard measure or set of measures of self-efficacy that are relevant to PEBs could assist with comparing the results of studies using Theory of Planned Behavior, playing a similar role to the one that New Ecological Paradigm plays in relation to environmental attitudes. Many different scales have been used by researchers, but they measure different aspects of efficacy (Roser-Renouf, 2008). In the case of studies two and three in this dissertation, the instrument may have been measuring more than self-efficacy. Standard instruments would assist in interpreting results and implementing interventions based on Theory of Planned Behavior.

Conclusion

These three studies are gradual steps toward understanding a path to meaningful behavior change. Our ways of thinking and ways of life are built into our behaviors. The role of moral foundations messaging, self-efficacy, and perceptions of responsibility offer insights into people's lives. These insights may facilitate better communication and more effective behavior change.

Change is inevitable on any path forward. Voters, policymakers, sustainability practioners, climate communicators, social scientists, climate scientists, business people, activists, and others have the opportunity to influence how changes shape our societies. Individual change is one facet of the transition to a more sustainable operating system. These studies contribute by exploring the factors that influence individual behavior and attribution of responsibility. They also explore the roles Americans envision for themselves and other organizations in addressing climate change. Understanding these relationships can help direct our path forward.

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APPENDICES

A: Studies on Carbon and Ecological Calculators and Behavior

	Question	Conclusion	Limitations	Interview/Survey measure	Measured actual behavior	Empirical analysis
(Brook, 2011)	Tests the effect of EF feedback on political pro-environmental behavior and environmental invested self-esteem affects results	Ecological footprint feedback showed benefits for people with self-esteem tied to environmentalism and negative feedback marginally increased PEB among people who tied self-esteem to environmentalism	1. The study compared receiving negative and positive EF feedback but not no feedback or accurate feedback. 2. University student audience may not be representative of the general population. 3. It measured only political behavior and not other types. 4. Measured only contingent self-worth as a moderator and not other possible factors.		✓	✓
(Chatterton et al., 2009)	Examine the effect of a carbon calculator on travel behavior	Users' knowledge of climate change had little effect on travel behavior. Convenience, comfort, time, and money were more important in decision-making. Researchers suggest tying travel behavior to more immediate self-interest might be more effective.	1. Small sample size 2. Potentially biased sample selected through offsetting companies 1. No objective measure of change in the participants' EF.			
(Fitzpatrick et al., 2015)	Evaluates the carbon footprints of two lecturers	Concludes both individual and societal change are required to reach a sustainable level of consumption	2. Uses a "tailor-made" calculator, making comparison to any existing calculator difficult 3. Case study/small sample is not definitely generalizable			
(Franz & Papyrakis, 2011)	Evaluates online EF calculators	Even the lowest footprint options led to exceeding the planet's biocapacity, suggesting people can delay but not prevent environmental catastrophes.	It is speculative about the effects of calculators on behavior, lacks empirical data.			
(Gottlieb et al., 2012)	Assesses EF in a high school and uses it as an educational technique for students	Concludes EF promotes connections between local activities and global effects, and it should be taught as in a multidisciplinary context	1. Case study is so broad as to be unhelpful 2. No objective measure of change in the participants' EF.			Descri ptive
(Gram-Hanssen & Christensen, 2012)	Evaluates the role of calculators in changing behavior and affecting knowledge. Gauges user reactions	Users are primarily people already interested in the footprint subject. Users accept an individual approach but question division of responsibility. Users are more willing to change electricity behaviors and least likely to change air travel and a second home. The majority of users in a follow-up survey changed no behaviors. Researchers recommend calculators suggest collective actions to avoid a	1. The focus group sample size is small, focusing on feedback was from 18 people in three focus groups 2. The survey data analysis is vague. 3. No control group 4. No objective measure of change in the participants' EF. 5. Recommendations are not well cited.	✓		Limit ed

		user feeling of victim blaming.				
(B. Kim & Neff, 2009)	Evaluates online carbon dietary calculators	Recommends rigorous methodologies and transparency of methodologies. Suggests calculators communicate both ecological and public health benefits of low carbon diets to users.	The study evaluates the methods of calculators rather than the efficacy of behavior change.			
(Lambert, 2013)	Tests the impacts of a "footprint challenge" campaign on self-reported pro-environmental behaviors of members of a university using an EF calculator as a pre and post-test	Footprint challenge participants decreased their EF by an average of 10.3%.	1. Self-selected participants 2. Participants who felt they had failed to reduce their footprint may have opted out of the post-test or reported reduction in their footprints. 3. No objective measure of change in the participants' EF. 4. University audience may not be representative of the general population.	✓		✓
(Mallett et al., 2013)	Tests the effect of carbon footprint on guilt, pride, and support for a pro-environmental group	Evidence that Americans had a carbon footprint greater than average, was associated with guilt, which was associated with greater support for joining and working for a pro-environmental group.	1. University student audience may not be representative of the general population. 2. The study compared receiving negative and positive EF feedback but not no feedback or accurate feedback. 3. Measured intentions, not PEB	✓		✓
(Sutcliffe et al., 2008)	Tests EFA at the household level evaluate its potential for promoting PEB	High environmental attitude scores among households led to impact reductions	1. Participants may have felt pressured to report reduction in their footprints. 2. No objective measure of change in the participants' EF. 3. Small sample size	✓		Mostly descriptive
(Toner et al., 2014)	Tests the differences in intention, attitudes, and beliefs based on feedback regarding a participant's impact and participant's group's impact	Feedback indicating participants were less environmentally conscious than their peers motivated them to change their intentions but not necessarily their attitudes	1. University student audience may not be representative of the general population. 2. The study compared receiving negative and positive EF feedback but not no feedback or accurate feedback. 3. Relatively small sample 4. Measured intentions, not PEB	✓		✓
(Truelove, 2009)	Tests the ability of EFCs to increase GW behavioral intention	EFC feedback with and without a list of PEBs failed to increase intention and led to lower beliefs of self-efficacy	1. University student audience may not be representative of the general population. 2. Relatively small sample 3. Emotion scales were delayed by the efficacy scales, possibly altering results. 4. Measured intentions, not PEB	✓		✓

(West et al., 2016)	Describes the development and use of REAP Petite carbon calculator, which allows users to compare their impact with others and pledge to change behavior	Recommends a dashboard of indicators, so people can focus on indicators important to them. Researcher found getting people to interact with the tool was a challenge. Respondents seemed to be people already knowledgeable.	The article focuses on the design of a calculator but does not focus on the results of the calculator.			
(Brook, 2011; Chatterton et al., 2009; Fitzpatrick et al., 2015; Franz & Papyrakis, 2011; Gram-Hanssen & Christensen, 2012; Lambert, 2013; Mallett et al., 2013; Sutcliffe et al., 2008; Toner et al., 2014; Truelove, 2009; West et al., 2016)						

B. Moral Foundations Interventions

Harm/Care Message: We Must Stop Harming the Environment

Images from top:

- Image 5: b15_p463_16 From the Moral Image Database (Crone Et Al., 2018)
- Image 6: Pixabay, Licensed under Creative Commons
- Image 7: ID: reef3206, NOAA's Coral Kingdom Collection, Photographer: David Burdick
- Image 8: b15_p473_6 From the Moral Image Database (Crone Et Al., 2018)*l., 2018)*

Get Started

Now more than ever it is important that we protect our natural habitats and start caring about the environment. Preventing destruction of our forests, drinking water, and skies is of vital importance.

Travel

Protecting the earth is important. The air pollution that vehicles produce harm human health, causing respiratory problems and higher risks of cancer. The emissions also cause acid rain to fall from the skies, damaging plant, and animal life.

Home

Human extraction of mineral resources for vehicles, energy generation, and manufacturing has destroyed landscapes and killed off countless animals and plants. This has indirect, harmful effects for humans as many plant species that we kill off could be used to make medicines to protect human lives.

Food

Deforestation for food production has led to the erosion of topsoil, making formerly fertile land into useless deserts. The result is barren soil across the world, making it harder to produce food, resulting in famine and starvation.

From top to bottom:

- *Flickr Aaron Gustafson, CC BY-SA 2.0*
- Original Photo, Alexi Lamm

Shopping

When we use endless amounts of goods it leads to dumping of waste and chemicals into our water. These pollutants and rising temperatures have resulted in the deaths of billions of fish and the destruction of valuable habitat, such as coral reefs.

Your footprint

The good news is that we can stop harming the environments we live in, protecting them from further damage. Simply reducing landfill-bound waste, choosing energy efficient appliances, and driving less can make a big difference. It should be everyone's goal to care for the environment, so our children and our children's children can experience a healthy and thriving natural environment.

Purity/sanctity message: We Must Protect the Purity of the Environment

Get Started

Now more than ever it is important that we protect our natural habitats from desecration and pollution. Keeping our forests, drinking water, and skies pure is of vital importance.

Travel

Preserving purity is important. The air pollution that vehicles produce makes the once crisp, pure blue sky a foul gray color. Our environment is sacred, and pollution in our environment inevitably contaminates us and our bodies.

Home

Chemical particles from vehicles, energy generation, and manufacturing end up everywhere – in our food, on our skin, and inside our lungs. When we live near toxic sites or inhale dirty, smog-filled air, they actually enter our bodies and become a part of us.

From top to bottom:

- Wikimedia Michelle Arseneault, CC BY-SA 3.0
- b11_p169_10 from the Moral Image

Food

Deforestation for food production turns once pristine wilderness into barren, depleted fields. Runoff from farms contaminates the water we drink. Even the livestock we eat deposit fecal matter in pristine mountain streams polluting recreational and drinking water.

Shopping

When we use endless amounts of goods it leads to mountains of disgusting, reeking trash across our natural landscapes. Billions of tons of garbage have to be put into landfills—many of which possess toxic chemicals that seep into our water supply, making even filtered water contaminated.

Your footprint

The good news is that we can defend and decontaminate the environments we live in, making them pure again. Simply reducing landfill-bound waste, choosing energy efficient appliances, and driving less can make a big difference. It should be everyone's goal to cleanse the environment, so our children and our children's children can experience the uncontaminated purity and beauty of nature.

Control message

Get Started

A healthy life and environment are important. The air pollution that vehicles produce can contribute to diseases such as respiratory problems and higher risks of cancer. Pollution can also lead to acid rain and gray, hazy skies.

Travel

Now more than ever it is important that the environment continues to provide resources for human society. Forests, drinking water, and clear skies are all essential to a happy, healthy, safe human life.

Home

Chemical particles from vehicles, energy generation, and manufacturing also enter the air we breathe and the natural areas. Extraction of mineral resources for vehicles, energy generation, and manufacturing permanently changes landscapes. These landscape changes a ect the lives of the humans and wildlife that depend on the land.

Images from top to bottom:

- Image 9: B15_P330_15 from the Moral Image Database (Crone et al., 2018)
- Image 10: B1_P4_12 from the Moral Image Database (Crone et al., 2018)
- Image 11: B999_P481_13 from the Moral Image Database (Crone et al., 2018)
- Image 12: B2_P27_7 from the Moral Image Database (Crone et al., 2018)

Food

Deforestation for food production depletes soil and leads to erosion. Food becomes harder to produce in barren soil, and yields decline. Furthermore, runoff from farms and ranches enters ponds, rivers, oceans, and seas.

Shopping

When we use endless amounts of goods it leads to trash in the landscapes. Billions of tons of garbage enter the landfills – many of which possess chemicals. Some of these chemicals enter our water. These pollutants and rising temperature have negatively affected humans and numerous animals.

Your footprint

The good news is that we can do something for the environments we live in. Simply reducing land- fill bound waste, choosing energy efficient appliances, and driving less can make a big difference. It should be everyone's goal to improve the places we live, so our children and our children's children can experience nature for generations to come.

C. Study 1 Variables

i. Sex	Categorical nominal: (0) Female, (1) Male, (2) Other
ii. Age	Categorical interval: Years 18-99
iii. Household income	Categorical interval: 1 (less than 20k) to 5 (more than 80k)
iv. Race	Categorical nominal: 0-7 0 (white), 2 (Black or African American), 3 (American Indian or Alaska Native), 4 (Asian), 5 (Native Hawaiian or Pacific Islander), 6 (Latino or Hispanic or Mexican), 7 (Other or more than one)
v. Education	Categorical ordinal: 1 (high school graduate or less) to 5 (advanced degree)
vi. Household size	Categorical interval: Members 1, 2, 3, 4, 5, 6+
vii. Political identity	Categorical ordinal: 1 (very liberal) to 5 (very conservative)
viii. Vote 2016	Categorical: 0 (Did not vote), 1 (Trump), 2 (Clinton), 3 (McMullin), 4 (Other)
ix. Environmental behaviors	Behavior changes: 0 (no) and 1 (yes) for each Began charging EV at home, Began working from home, Installed solar panels
x. Carbon footprint reading	Continuous: tons CO2/year
xi. MFQ	Categorical interval: 0-30 on each of the five foundations
xii. Neighborhood	Categorical nominal: identified by city meter reading cycles and routes
xiii. Electrical consumptions months 1-3	Continuous: kWh
xiv. Food	Categorical ordinal: a. Wasted food: 4 (Not at all), 3 (1-2 meals), 2 (3-4 meals), 1 (5-6 meals), 0 (7 or more meals) b. Meat or plant-based: 0 (Not at all), 1 (1-4 meals), 2 (5-8 meals), 3 (9-12 meals), 4 (13 or more meals)
xv. Electricity	Categorical ordinal: 0 (Never), 1 (Rarely), 2 (About half the time), 3 (Often), 4 (Always)

xvi. Transportation	Categorical ordinal: 0 (Not at all, 1 (1-3 times), 2 (4-6 times), 3 (7-9 times), 4 (10 or more times)
xvii. Message	Categorical nominal: 0 (no) and 1 (yes) for each non-moral, binding, individualizing

D: Study 1 Behavioral Questions

Transportation	**Food**	**Electricity**
During the past two weeks,		
How often have you: 1. carpooled?[a] 2. used public transportation?[a] 3. walked or cycled instead of driving?[a] *Responses are measured in trips. A trip is any travel between two locations. Travel back to the original location or somewhere else is another trip.*	How often have you: 1. eaten meat?[b] 2. thrown away at a serving of food because it could not be eaten?[c] 3. eaten 80% plant-based meals?[d] *Responses are measured in meals. A meal is any of the regular occasions in a day when a reasonably large amount of food is eaten, such as breakfast, lunch, or dinner.*	How often have you: 1. switched off all the lights when leaving a room as last person?[e] 2. switch off standby when electric devices are not used?[e] 3. Switched off the computer when it is not used?[e]

a) Carpool, public transit, active transportation: 0 (no trips), 1 (1-3 trips), 2 (4-7 trips), 3 (7-9 trips), 4 (10 and above)
b) Meat: 0 (13 or more meals), 1 (9-12 meals), 2 (5-8 meals), 3 (1-4 meals), 4 (Not at all)
c) Wasted food: 0 (7 or more servings), 1 (5-6 servings), 2 (3-4 servings), 3 (1-2 servings), 4 (Not at all)
d) Plant-based: 0 (Not at all), 1 (1-4 meals), 2 (5-8 meals), 3 (9-12 meals), 4 (13 or more meals)
e) Values are a 5-point Likert scale: "never," "rarely," "about half the time," "often," "always."

Participants reported their weekly behavior. Indicators were adapted from Markle, 2013.

E. Moral Foundations Questionnaire

Part 1. When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking? Please rate each statement using this scale:

[0] = not at all relevant (This consideration has nothing to do with my judgments of right and wrong)
[1] = not very relevant
[2] = slightly relevant
[3] = somewhat relevant
[4] = very relevant
[5] = extremely relevant (This is one of the most important factors when I judge right and wrong)

_____Whether or not someone suffered emotionally

_____Whether or not some people were treated differently than others

_____Whether or not someone's action showed love for his or her country

_____Whether or not someone showed a lack of respect for authority

_____Whether or not someone violated standards of purity and decency

_____Whether or not someone was good at math

_____Whether or not someone cared for someone weak or vulnerable

_____Whether or not someone acted unfairly

_____Whether or not someone did something to betray his or her group

_____Whether or not someone conformed to the traditions of society

_____Whether or not someone did something disgusting

_____Whether or not someone was cruel

_____Whether or not someone was denied his or her rights

_____Whether or not someone showed a lack of loyalty

_____Whether or not an action caused chaos or disorder

_____Whether or not someone acted in a way that God would approve of

Part 2. Please read the following sentences and indicate your agreement or disagreement:

[0]	[1]	[2]	[3]	[4]	[5]
Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree

_____Compassion for those who are suffering is the most crucial virtue.

_____When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.

_____I am proud of my country's history.

_____Respect for authority is something all children need to learn.

_____People should not do things that are disgusting, even if no one is harmed.

_____It is better to do good than to do bad.

_____One of the worst things a person could do is hurt a defenseless animal.

_____Justice is the most important requirement for a society.

_____People should be loyal to their family members, even when they have done something wrong.

_____Men and women each have different roles to play in society.

_____I would call some acts wrong on the grounds that they are unnatural.

_____It can never be right to kill a human being.

_____ I think it's morally wrong that rich children inherit a lot of money while poor children inherit nothing.

_____ It is more important to be a team player than to express oneself.

_____ If I were a soldier and disagreed with my commanding officer's orders, I would obey anyway because that is my duty.

_____ Chastity is an important and valuable virtue.

The Moral Foundations Questionnaire (full version, July 2008) by Jesse Graham, Jonathan Haidt, and Brian Nosek.
For more information about Moral Foundations Theory and scoring this form, see:
www.MoralFoundations.org

F: Survey for Studies 2 and 3

Attribute	Questions	Scale
PEBs (Truelove & Gillis, 2018)	Please sort the behaviors below into the categories reflecting your behavior. Please answer for your household. **Transportation** 1. Combine errand trips 2. Walk or cycle short trips 3. Carpool 4. Drive or purchase a fuel-efficient vehicle 5. Maintain correct tire pressure	1. Currently do 2. Could do but don't 3. Could do and planning to 4. Could not do
	Energy 6. Line dry laundry 7. Use or switch to energy efficient light bulbs 8. Caulk/weather-strip doors and windows of home 9. Use or install an energy-efficient water heater 10. Adjust water heater to no higher than 120 degrees F	
	Food 11. Eat a vegetarian diet one day a week 12. Choose a vegetarian meal over a beef dish 13. Choose meat or eggs from open-pasture raised animals	
	Activism 14. Donate to an environmental organization 15. Take part in a protest about an environmental issue 16. Write a government official about an environmental issue 17. Sign a petition about an environmental issue 18. Vote for a pro-environmental policy	
Follow-up for behaviors in "could do but don't" category	For the behaviors in which you could do and do not currently do, please select the explanation that most closely reflects your decision. Select all that apply. I do not __[insert PEB]__ because…	1. I choose not to pursue it and am not interested. 2. I choose not to pursue it under current circumstances 3. BUSINESSES should spearhead ways to address this issue. 4. NON-PROFITS should spearhead ways to address this issue.

		5. GOVERNMENTS should spearhead ways to address this issue. 6. Other	
Follow-up for my responsibility, and I choose not to pursue it with the choice someone else's responsibility in my household who chooses not to pursue it.	For the selected behaviors, why did you or someone in your household choose not to pursue behaviors?	Open-ended	
Follow-up for my responsibility, and I choose not to pursue it with the choice businesses should do something about this, non-profits should do something about this, or governments should do something about this.	For the selected behaviors, why do you feel another organization would be best to pursue the topics you placed in that category?	Open-ended	
ENVIRONMENTAL ATTITUDES Full revised NEP (Dunlap et al., 2000; López-Bonilla & López-Bonilla, 2016)	Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you strongly agree, mildly agree, are unsure, mildly disagree, or strongly disagree with it. 1. Humans are severely abusing the environment. 2. Despite our special abilities humans are still subject to the laws of nature. 3. The earth is like a spaceship with very limited room and resources. 4. The balance of nature is very delicate and easily upset. 5. If things continue on their present course, we will soon experience a major ecological catastrophe.	Strongly disagree (1)	Strongly agree (5)
SELF-EFFICACY (Kellstedt et al., 2008)	The following statements are about climate change and global warming. Please indicate if you strongly agree, agree, disagree, or strongly disagree with each of them 1. I believe my actions have an influence on global warming and climate change.	Strongly disagree (1)	Strongly agree (4)

	2. My actions to reduce the effects of global warming and climate change in my community will encourage others to reduce the effects of global warming through their own actions. 3. Human beings are responsible for global warming and climate change.		
MORAL FOUNDATIONS *(Graham et al., 2009)*	*The following two pages will ask about your considerations in decision-making.* Part 1. When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking? Please rate each statement using this scale: • *Not at all relevant (has nothing to do with my judgments of right and wrong) to* • *Extremely relevant (one of the most important factors when I judge right and wrong)* Whether or not... • Someone suffered emotionally • Someone violated standards of purity and decency • Someone was good at math • Someone cared for someone weak or vulnerable • Someone did something disgusting • Someone was cruel • Someone acted in a way that God would approve of Please read the following sentences and indicate your agreement or disagreement: • Compassion for those who are suffering is the most crucial virtue. • People should not do things that are disgusting, even if no one is harmed. • It is better to do good than to do bad. • One of the worst things a person could do is hurt a defenseless animal. • I would call some acts wrong on the grounds that they are unnatural. • It can never be right to kill a human being. • Chastity is an important and valuable virtue.	Not at all relevant (1) Strongly disagree (1)	Extremely relevant (6) Strongly agree (6)
GUILT AND SHAME PRONENESS SCALE (T. R. Cohen et al., 2011)	*In this questionnaire you will read about situations that people are likely to encounter in day-to-day life, followed by common reactions to those situations. As you read each scenario, try to imagine yourself in that situation. Then indicate the likelihood that you would react in the way described.* 1. *After realizing you have received too much change at a store, you decide to keep it because the salesclerk doesn't notice. What is the likelihood that you would feel uncomfortable about keeping the money?*	Very Unlikely (1)	Very Likely (7)

	2. *You are privately informed that you are the only one in your group that did not make the honor society because you skipped too many days of school. What is the likelihood that this would lead you to become more responsible about attending school?* 3. *You rip an article out of a journal in the library and take it with you. Your teacher discovers what you did and tells the librarian and your entire class. What is the likelihood that this would make you would feel like a bad person?* 4. *After making a big mistake on an important project at work in which people were depending on you, your boss criticizes you in front of your coworkers. What is the likelihood that you would feign sickness and leave work?* 5. *You reveal a friend's secret, though your friend never finds out. What is the likelihood that your failure to keep the secret would lead you to exert extra effort to keep secrets in the future?* 6. *You give a bad presentation at work. Afterwards your boss tells your coworkers it was your fault that your company lost the contract. What is the likelihood that you would feel incompetent?* 7. *A friend tells you that you boast a great deal. What is the likelihood that you would stop spending time with that friend?* 8. *Your home is very messy and unexpected guests knock on your door and invite themselves in. What is the likelihood that you would avoid the guests until they leave?* 9. *You secretly commit a felony. What is the likelihood that you would feel remorse about breaking the law?* 10. *You successfully exaggerate your damages in a lawsuit. Months later, your lies are discovered and you are charged with perjury. What is the likelihood that you would think you are a despicable human being?* 11. *You strongly defend a point of view in a discussion, and though nobody was aware of it, you realize that you were wrong. What is the likelihood that this would make you think more carefully before you speak?* 12. *You take office supplies home for personal use and are caught by your boss. What is the likelihood that this would lead you to quit your job?* 13. *You make a mistake at work and find out a coworker is blamed for the error. Later, your coworker confronts you about your mistake. What is the likelihood that you would feel like a coward?* 14. *At a coworker's housewarming party, you spill red wine on their new cream-colored carpet. You cover the stain with a chair so that nobody notices your mess. What is the likelihood that you would feel that the way you acted was pathetic?* 15. *While discussing a heated subject with friends, you suddenly realize you are shouting though nobody seems to*		

	notice. What is the likelihood that you would try to act more considerately toward your friends? 16. *You lie to people but they never find out about it. What is the likelihood that you would feel terrible about the lies you told?*	
GENDER	To which gender identity do you most identify?	1. Male 2. Female 3. A gender not listed
AGE	What is your year of birth?	
RACE	With which racial and ethnic group(s) do you identify? (Mark all that apply.)	1. American Indian or Alaska Native 2. Asian 3. Black or African American 4. Hispanic or Latino 5. Native Hawaiian or Pacific Islander 6. White 7. Other If more than one, then 7.
EDUCATION	What is the highest degree or level of school you have completed? (If you are currently enrolled in school, please indicate the highest degree you have received.)	1. High school graduate or less 2. Some college, no degree 3. Technical college or associate's degree 4. Bachelor's degree 5. Advanced degree
INCOME	In the past year, what was your total household income before taxes? Please count income from all members of your household from all sources.	1. less than $20,000 2. $20,000-$39,999 3. $40,000-$59,999 4. $60,000-$79,999 5. $80,000-$99,999 6. $100,000+
POLITICALID	What is your political identity?	1. Very conservative 2. Conservative 3. Middle of the road 4. Liberal 5. Very Liberal 6. Libertarian
Zip code	Please enter your zip code.	

G: Curriculum Vitae

Alexi Elizabeth Lamm

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Education

Ph.D. Candidate — Utah State University
Environment and Society — May 2021 — GPA 4.0
Dissertation: *Moral Foundations in Behavior Change*

Master of Public Affairs — Indiana University
Environmental Policy and Natural Resource Management — May 2012 — GPA 3.85

Bachelor of Fine Arts, *Magna cum laude, with honors* — Arkansas State University
Graphic Design — May 2007 — GPA 3.92

Experience

Sustainability Coordinator 2012- Present
Utah State University Facilities Logan, UT
Promote a culture of environmental sustainability on campus community and facilitate advancement of sustainability goals

- Develop curriculum and teach a two-credit sustainability practicum and service-learning course. Course evaluation ratings are "much higher" than similar courses in *progression on relevant objectives* and "higher" in *excellent teacher* and *excellent course* ratings. Additionally, I assisted in a broadcasted statewide "communicating sustainability" course.
- Develop and implement annual faculty workshop for integrating sustainability in curriculum, in coordination with faculty planning committee. The faculty who have participated in the first five years of the program have taught over 6000 students.
- Complete Sustainability, Tracking, Assessment and Rating System (STARS) and structure university sustainability plan. The university has completed the STARS process three times at a silver level with a score increase of seven points.
- Chair Sustainability Council and liaise with work groups: Academics; Air Quality & Transport; Community, Culture, & Communication; and Energy & Built Environment
- Engagement programs: Energy Wars, RecycleMania, National Bike Challenge, Green Office program, Commuter Club, and others. The university won the National Bike Challenge four times since 2013. Energy Wars resulted in winning buildings reducing electricity 7%-20% from their own baseline.
- Manage communications: website maintenance, print materials, email newsletter, social media, and sustainability presentations to faculty, student orientations, and classes.
- Mentor and supervise four AmeriCorps student interns
- Coordinate LEED credits with the university's contracted architects
- Apply and assist with applications for small grants: Utah Clean Air Partnership (UCAIR) EV Charger; UCAIR Electric Vehicle; UCAIR Bikeshare; Utah Department of Environmental Quality Clean Air Retrofit, Replacement, and Off-

Road Technology (CARROT) Grant; Keep America Beautiful Recycling Bin Grant; Pepsi Zero Impact Fund for processing campus compost into a soil amendment

Sustainability Intern 2010- 2012
Indiana University Bloomington, Indiana
Academic initiatives intern: *Tracked sustainability-related research, organizations, and courses*
Results: *Created more easily updatable interface with sustainability course listings and a new interface to highlight sustainability research*

Community Sale Coordinator: *Coordinated city, university, and community partners; organized donations, volunteers, and publicity*
Results: *Increased collection from 20 to 27 tons, proceeds from $10,470 to $17,420, and volunteers from 100 to 200*

Health Education Volunteer 2008- 2010
United States Peace Corps Albania
Developed and delivered health education lessons and materials. Worked with local partners, including community activist, high school students and district nurses to develop and implement Plastic Bag Project and Breast Cancer Awareness Initiative

Graphic Designer 2007- 2008
Eden Medical Spa and Boutique Jonesboro, Arkansas
Designed promotional materials, photographed merchandise, and updated the website

Skills

Software
Microsoft Office
Adobe Creative Suite

ArcGIS, R
Albanian language
LEED Green Associate

Publications

Fischman, R. L., Meretsky, V. J., Freeman, K., **Lamm, A.**, Missik, L., & Salmon, S. (2017). An Evaluation of US National Wildlife Refuge Planning for Off-Road Vehicle Use. Journal of Fish and Wildlife Management.

Stafford, E. R., & **Lamm, A.** (2016). Developing Community Clean Air Public Service Announcements: A Typology of Message Sources and Appeals and Our Path Forward. Sustainability: The Journal of Record, 9(5), 232-240.

Lamm, A. & Stafford, E. R. (2014). Framing Sustainability for the Free, Frugal, and Fit & Fabulous. The Solutions Journal. 5(2), 31-36.

Presentations

Lamm, A. (2020). It Isn't Easy Speaking Green. North American Association for Environmental Education Conference and Research Symposium. Virtual poster.

Belmont, P; **Lamm, A.** (2020, accepted and canceled for COVID-19). Overcoming Inertia: Constructive Disruption. Intermountain Sustainability Summit. Ogden, Utah.

Lamm, A. (2016). Selling Clean Air: Understanding Message Appeals and Sources. Intermountain Sustainability Summit. Ogden, Utah.

Lamm, A; Carr, J; Landrum, N; Stafford, E. (2014). Promoting Conservation on Conservative Campuses. Association for the Advancement of Sustainability in Higher Education Conference. Portland, Oregon.

Tomlin, S; **Lamm, A**; Damitz, S; Duerden, M. (2014). Sustainability Programs at Utah State University. Intermountain Sustainability Summit Conference. Ogden, Utah.

Lamm, A. (2011). Hoosier to Hoosier: Reducing Student Move-out Waste with the City. Association for the Advancement of Sustainability in Higher Education Conference. Pittsburgh, Pennsylvania.

Lamm, A. (2011). Student Panel. Wikipedia in Higher Education Summit. Boston, Massachusetts.

Grants

Graduate Research and Creative Opportunities Grant 2018

The Nature Conservancy support for dissertation research

Honors & Awards

Environmental Leadership Program National Fellow 2017-2018

Envision Utah *Your Utah, Your Future* award for the Drive Electric Program, in collaboration with Utah Clean Energy, Weber State University, University of Utah, UCAIR, and Salt Lake City 2017

USU Facilities Directors' Award 2017

Brian Andersen Memorial Scholarship 2016-2017

Utah State University Facilities Employee of the Month, October 2014

Activities

Cache Clean Air Consortium 2015- present

Cache County Bicycle Pedestrian Advisory Committee Member, 2012- present

Cache County Bicycle Pedestrian Advisory Committee Interim Chair, 2019- present

Bear River Watershed Council Board Member 2014-2016

Indiana University Academic Initiatives Working Group Member 2011- 2012

Indiana University Resource Use and Recycling Working Group Member 2010- 2012

Indiana University Hoosier to Hoosier Community Sale Steering Committee 2010-2012